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REPORT

ON THE

SCIENTIFIC RESULTS

OF THE

VOYAGE OF H.M.S. CHALLENGER

DURING THE YEARS 1873-76

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REGIUS PROFESSOR OF NATURAL HISTORY IN THE UNIVERSITY OF EDINBURGH
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ZOOLOGY—VOL. XIII.

PART XXXVII.—REPORT ON THE SCHIZOPODA.

BY PROFESSOR G. O. SARS.

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EDITORIAL NOTE.

THIS Part consists of a Report on the Schizopoda of the Expedition, by the well-known Carcinologist, Professor G. O. Sars, of Christiania. In addition to the present Report, Professor Sars has undertaken another on the Cumacea and Phyllocarida, which will be published in the course of next year.

The Manuscript was received by me in batches between 27th November 1884, and 7th July 1885.

JOHN MURRAY.

CHALLENGER OFFICE, 32 QUEEN STREET,
EDINBURGH, 1*st October* 1885.

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the SCHIZOPODA collected by H.M.S. Challenger during the Years 1873–76. By Professor G. O. SARS of the University of Christiania.

INTRODUCTION.

OF the very extensive collections of Crustacea made during the Challenger Expedition, the two interesting groups, the Schizopoda and the Cumacea, have been placed in my hands, by Mr. John Murray, for examination and description.

In the present Report only the first of these groups, the Schizopoda, is treated of. The Cumacea will subsequently be described and figured in a separate Report, which will be issued as soon as possible, and to which will be appended a short Report on the Challenger Phyllocarida.

The collection of Schizopoda procured during the long voyage of H.M.S. Challenger has turned out extremely rich and of very special interest, containing, as it does, several most remarkable new types, the examination of which has led to a much fuller comprehension of the morphology of the Schizopoda and their relation to other Crustacea than we previously possessed. The various collections having been made in widely distant tracts of the ocean, an important contribution to the geographical distribution of species has likewise been acquired.

Very special regard had already been paid to this interesting group of Crustacea by the late Dr. R. v. Willemoes-Suhm, whose untimely death, during the Expedition, was so deeply deplored by his friends and the scientific world.

In a very interesting treatise on the Atlantic Crustacea from the Challenger Expedition, that appeared in the Transactions of the Linnean Society of London,[1]

[1] *Trans. Linn. Soc. Lond.* (Zool.), ser. 2, vol. i. p. 23, 1875.

this distinguished zoologist has characterised and figured, together with various other Crustacea, several striking forms of Schizopoda, that have proved to be of a truly remarkable interest, and which, in the sequel, will be more fully treated of, with due reference to the treatise of that lamented author.

Moreover, I have had the opportunity of referring to drawings and notes made by the late v. Willemoes-Suhm during the Expedition, as also to a few partly coloured sketches of Schizopoda, executed by Sir Joseph Hooker on the Antarctic Expedition in 1839–40, under the command of Sir James Clark Ross, all of which have kindly been placed in my hands by Mr. John Murray.

In a preliminary paper, published in the Transactions of the Christiania Scientific Society for 1883,[1] I have briefly characterised the new genera and species of Schizopoda from the Challenger Expedition, which are more fully described in the following Report.

Principal Works on Schizopoda.

Milne-Edwards, H., Histoire Naturelle des Crustacés, t. ii., Paris, 1837.

Bell, T., History of British Stalk-eyed Crustacea, Appendix, London, 1853.

Dana, J. D., United States Exploring Expedition—Crustacea, part i., Philadelphia, U.S.A., 1852.

Beneden, P. J. v., Recherches sur la faune littoral de Belgique—Crustacés. *Mém. Acad. Sci. Bruxelles*, t. xxxiii., 1861.

Kröyer, H., Et Bidrag til Kundskaben om Krebsdyrfamilien Mysidæ. *Nat. Hist. Tidskr.*, Række 3, Bd. i., 1861–63.

Claus, C., Ueber einige Schizopoden und niedere Malacostraken Messina's. *Zeitschr. f. wiss. Zool.*, Bd. xiii. p. 422, 1863.

——— Ueber die Gattung Cynthia als Geschlechtsform der Mysideengattung Siriella. *Zeitschr. f. wiss. Zool.*, Bd. xviii. pp. 271–279, 1868.

Sars, M., Beskrivelse over Lophogaster typicus. Universitets program, Christiania, 1862. (Trans.) *Ann. and Mag. Nat. Hist.*, ser. 3, vol. xix. pp. 461, 462, 1864.

Suhm, R. v. Willemoes-, On some Atlantic Crustacea from the Challenger Expedition. *Trans. Linn. Soc. Lond.* (Zool.), ser. 2, vol. i. pp. 23–58, 1875.

Boas, J. E. V., Studien über die Verwandschaftsbeziehungen der Malacostraken. *Morphol. Jahrb.*, Bd. viii. pp. 485–579, 1883.

Sars, G. O., Histoire Naturelle des Crustacés d'eau douce de Norvège, 1e Livraison, Les Malacostracés, Christiania, 1867.

——— Monographe over de ved Norges Kyster forekommende Mysider, Christiania, 1870–79.

——— Middelhavets Mysider. *Archiv f. Mathem. og Naturkundskab*, Bd. i. pp. 1–111, 1876.

——— Preliminary Notices on the Schizopoda of H.M.S. Challenger Expedition. *Forhandl. Vidensk. Selsk. Christiania*, No. 7, 1883.

[1] *Vide, op. cit.*

Terminology.

Concerning the terminology, I have deemed it advisable in the present Report to make use of that best known and most generally adopted by the carcinologists of the present time, though I am well aware that the usual terms have not in all cases a clearly defined scientific character. The manifold modifications, both in structure and functions, affecting almost every part of the body in this extensive class of Arthropoda, must, in my opinion, make it very difficult, if not quite impossible, to establish any nomenclature, that at the same time would give fully adequate terms for the several parts, and also be equally applicable to all forms of the class.

The attempts made with this object in view by certain eminent carcinologists, and most recently by Mr. C. Spence Bate, do not seem to have been generally accepted by specialists in this department, notwithstanding the great skill and inventive aptitude shown in constructing the new terms suggested.

In a strict sense, I think that one of the claims to attention presented by so decidedly new a terminology would be its unquestionable applicability, not only to all forms of Crustacea, but also, as invariably has been attempted with the older one, to its embracing the other classes comprised in the vast subkingdom of the Arthropoda (Pycnogonida, Arachnoida, Myriapoda, Insecta). This, however, would appear to have been far from the object of the above carcinologists. For not only have they restricted their investigations to the class of Crustacea, but it would also appear that the several new terms have been, in every sense, specially devised for some limited group of this class, generally one of the higher ones (Decapods, Amphipods). It is obvious, therefore, that many of the terms, constructed according to such a method, will not apply even to all the Crustacea, let alone to the other Arthropoda.

Indeed, if any attempt be made to construct a new and more generally applicable nomenclature, it seems imperatively necessary that the terms should be relatively indefinite, and, as a rule, not involving the designation of any specific physiological function, but merely structural characters in a more general sense. Only within limited groups would, perhaps to a certain extent, more definite designations be applicable, but even then merely as strict specific terms.

It is obvious that several of the new terms proposed by Mr. Spence Bate are of a strictly specific character, *e.g.*, pereion, pleon, gnathopoda, pereiopoda, pleopoda, and these terms therefore cannot, in my opinion, lay any claim to serve as generally applicable designations for all the Crustacea, although they are extremely significant and sufficiently adequate for some of the higher groups. Thus any carcinologist engaged in studying the very extensive order of Copepoda would, I feel convinced, hardly adopt the terms "pereion" and "pleon" in the same sense as that proposed by Spence Bate; for in those animals the middle section of the body ("pereion"

of Spence Bate), and not the posterior, is the one properly corresponding to the "pleon," its limbs being, in every case, true pleopoda. Moreover, the zoologist who has chosen for his special study the Cladocera or the Ostracoda, would hardly be inclined to apply the term "pleon" either to the middle or the posterior section, but more likely to the anterior (cephalon), to which are attached the only true swimming limbs (antennæ).

Of the limbs belonging to the middle section of the body, Mr. Spence Bate names the two anterior pairs "gnathopoda." This certainly may be quite correct as regards a number of the higher Crustacea, and more especially the Amphipoda, but by no means for all the lower forms, and the term should therefore merely be regarded as an epithet for a peculiar modification of those limbs in a few limited groups, precisely as chelipeds, fossorial legs, prehensile legs, &c.

Even within the restricted group of the Crustacea treated of in the present Report, which belong precisely to the same division (Podophthalmia) as that on which Mr. Spence Bate will report, we find no less than four different cases in point, not one of which would coincide with the proposed terminology. Thus in all known Mysidæ, and among the Lophogastridæ, at least in the genera *Lophogaster* and *Ceratolepis*, only the most anterior pair of these limbs can properly be named "gnathopoda." In the Lophogastrid genus *Gnathophausia*, too, this pair differs so slightly from the succeeding limbs that, in a strict sense, the term "gnathopoda" even here is very inappropriate. Again, in the Euphausiidæ, not only are all the limbs of this section true legs, but even the last pair of limbs belonging to the anterior section (cephalon)—the maxillipeds—have assumed a perfectly pediform structure. On the other hand, in the genus *Eucopia* we find, exclusive of the maxillipeds, no less than three of the succeeding pairs of limbs serving as subsidiary organs for mastication, or, more properly, modified as true gnathopoda.

Moreover, the terms "pleopoda" and "pereiopoda" would not seem to be strictly applicable to all Schizopoda. Thus, the limbs of the posterior division ("pleopoda" of Spence Bate) in all female Mysidæ, without exception, and also in some male forms, are found to be so rudimentary as not to serve in any sense as swimming organs, this function being merely restricted to the outer branches (exopods) of the limbs belonging to the middle section of the body ("pereion" of Spence Bate). Nor is generally the structure of the true legs in the Schizopoda such as to make them well adapted for the function of walking, or to serve as true pereiopoda; thus, in the Euphausiidæ the delicate structure and very restricted mobility of these limbs make them wholly unfit even to support the body when at the bottom.

Under such circumstances, I have felt some hesitation in adopting for this group of Crustacea the terminology proposed by Mr. Spence Bate, although I fully admit the strict scientific character and exactness of the terms as regards the greater part of the Podophthalmia. For reasons more fully set forth above, I have deemed it advisable to follow

the earlier method, in adopting for the several sections of the body, as well as for the respective limbs, designations more indefinite in character, and consequently applicable on a wider scale.

The terms most usually adopted for the two posterior sections of the body, viz., the "thorax" and "abdomen," are certainly in this respect preferable to the much more specific designations "pereion" and "pleon" proposed by Mr. Spence Bate. But as the sections so termed for the Crustacea do not correspond with those for Insects and other Arthropods, I have thought it better to select some other known designations of a similar indefinite kind. The terms "trunk" and "tail" seem to answer the purpose sufficiently well, and both have, too, been adopted by some carcinologists.

Concerning the several limbs, I do not regard it necessary to change the well known and familiar terms "antennæ, mandibles, maxillæ," which have, moreover, to a great extent, been adopted for other Arthropods. I have likewise seen fit to retain for the pair of limbs immediately succeeding the maxillæ, the usual term "maxillipeds," more especially since these limbs, as shown by Milne-Edwards, are found to belong to the foremost section of the body, and thus in every case, even should their structure be peculiarly modified, stand in more or less close relation to the oral parts. For all the limbs belonging to the succeeding or middle section, the indefinite term "limbs of the trunk" or "legs" may, in a more general sense, be applied, and only in the case of peculiar structural differences, the more specific terms "gnathopoda, chelipeds, fossorial legs, pereiopoda, whirling legs, natatory legs, prehensile legs," &c., are to be substituted. As regards the limbs belonging to the posterior section of the body (tail), for the same reason, the general designation "caudal limbs" may be adopted, and only in particular cases the specific terms "pleopoda, setiferous lamellæ, caudal stylets, opercular and branchial lamellæ," &c. The hindmost pair of caudal limbs, differing in most cases essentially from the preceding, may perhaps be termed, in accordance with the proposal of Mr. Spence Bate, "uropoda." Together with the last caudal segment (telson) these limbs form in the higher Crustacea the so-called "caudal fan."

To facilitate comprehension of the terminology made use of in the present Report, the most essential terms are given below. A more detailed explanation would, I think, be quite superfluous.

Adult animal (female, male).
Young animal. *Larva* (Nauplius-, Zoea-, Mysis-stage).
Pupa (in Lophogastridæ and Mysidæ).

A. *Anterior division of body* (cephalon and trunk). Free segments of trunk.
Carapace.—Rostrum (frontal plate); cervical sulcus; lateral wings of carapace; dorsal area; regions; dorsal spine; supra-orbital, antennal, and branchiostegal spines.

Epistome.—Anterior lip (labrum).

Posterior lip (metastoma).

1. *Eyes.*—Pedicle; cornea; ocular papilla.
2. *Antennulæ.*—Peduncle; flagella; male appendage.
3. *Antennæ.*—Basal part; terminal part (peduncle and flagellum); scale; basal spine.
4. *Mandibles.*—Body of mandible; masticatory part; cutting edge; molar protuberance; palp.
5. First pair of *maxillæ.*
6. Second pair of *maxillæ.* } Basal part; masticatory lobes; palp; exognath.
7. *Maxillipeds.*—Stem (basal part and palp); masticatory lobes; exopodite; epipodite.

8–14. *Limbs of the trunk* or *legs.*—Stem (coxal, basal, ischial, meral, carpal, propodal, terminal joints); exopod; epipod; gills; incubatory lamellæ; male sexual appendages.

Incubatory pouch (marsupium).

B. *Posterior division of body* or *tail.*—Caudal segments; epimera; præanal spine.

15–19. *Caudal limbs* (pleopoda; setiferous lamellæ; male copulatory appendages).

Terminal appendages of tail (caudal fan).

20. *Uropoda* (last pair of caudal limbs).—Basal part; terminal plates; auditory apparatus (in Mysidæ).
21. *Telson* (last caudal segment).—Terminal spines; apical incision.

Luminous globules ("accessory eyes" of earlier authors) in Euphausiidæ and *Gnathophausia* (?).

MORPHOLOGY OF THE SCHIZOPODA.

All the principal types of this group being represented in the collection made during the Challenger Expedition, it may, I think, be apposite to discuss here in what relation the Schizopoda stand to other Crustacea, and what is the systematic position to be at present assigned to these forms, as also how the group may properly be subdivided.

As is well known, Milne-Edwards, the great reformer of carcinology, ranked these Crustacea, of which, however, a few forms only had at that time been recorded, side by side with the Squillacea in his order Stomatopoda, ranging also therein the genus *Leucifer* together with certain spurious genera, that since then have been found to be only larval forms of other known Crustacea. Dana, in his great work on the Crustacea of the United States Exploring Expedition, adopts the views of Milne-Edwards as to the systematic position of the Schizopoda, ranging them in his order Anomobranchiata, which perfectly corresponds with the order Stomatopoda of the first named author; and several other carcinologists have since then done the same. Such a classification must, however, in my judgment, at present be regarded as decidedly unsatisfactory, the Schizopoda being undoubtedly much more nearly related to the Eubranchiata or Decapoda of Milne-Edwards than to the Anomobranchiata (Stomatopoda). It will, I think, be absolutely necessary to restrict the order Stomatopoda to the Squillacea only, a group of Crustacea differing in many points very materially from all other Podophthalmia, whereas the genus *Leucifer* may find its appropriate place side by side with *Sergestes*, among the lower Decapods (Penæidea). Thus the Schizopoda are either to be regarded as forming a distinct order, or to be ranged in the order of the Decapoda or Eubranchiata of Dana. The last mentioned view has also been held of late by several distinguished modern zoologists, and the striking similarity in their external form often exhibited by these Crustacea to the lower Macrura (Caridea), has even led certain of these zoologists to regard the Schizopoda as merely forming a section of that tribe of the Decapoda. In my opinion, however, it is more appropriate at present to assign to this group the rank of a distinct tribe or suborder, there being several well-marked characters distinguishing these Crustacea rather sharply from all other known Decapods.

Of such characteristics peculiar to the group, the following may be set forth :—

1. The presence of strongly developed natatory branches (exopods) on all the limbs of the trunk or legs is, perhaps, the most striking feature distinguishing this group, and

that from which the designation Schizopoda has been derived. There are, it is true, some few examples of Macrurans in like manner retaining the exopods throughout the adult stage, viz., the anomalous families Ephyridæ and Pasiphaidæ, as also certain of the Penæidea; but in none of those forms do these parts exhibit the strong development peculiar to the Schizopoda, nor do they seem to have any importance as organs of locomotion.

2. As to the oral parts, may be noticed the large size of the mandibular palp, which generally even exceeds in length the body of the mandible itself. The maxillæ, too, also exhibit a rather peculiar appearance, different from what is observed in any true Macruran. It may, however, be remarked, that the oral parts in the Euphausiidæ differ in several respects very materially from those in other Schizopoda.

3. Of the legs, as a rule, only the foremost pair are developed as true gnathopoda, whereas all the others generally exhibit a very uniform structure, none of them being, as is the case in other Podophthalmia, modified to cheliform or prehensile organs. In the Euphausiidæ, too, not only are all the legs as a rule uniform, but even the maxillipeds are quite pediform in structure. The genus *Eucopia* exhibits, it is true, in this respect a very striking anomaly; it appears, however, that the very peculiar structure of the legs in that genus is quite as different from what is typical in the higher Podophthalmia.

4. The mode in which the ova are borne in the females differs essentially from what has been observed in any other known form of Podophthalmia. In those Crustacea, as is well known, the caudal limbs (pleopoda) serve for affixing the roe, whereas in the Schizopoda the ova are invariably placed beneath the trunk, generally enclosed within a pouch, or marsupium, consisting, as in Amphipods and Isopods, of a certain number of lamelliform leaflets, issuing from the bases of the legs. True, in the Euphausiidæ, incubatory lamellæ are wanting; but even here the position of the ova beneath the trunk is precisely the same as in other Schizopoda.

5. The development of most Schizopoda exhibits a very striking resemblance to that of the Isopoda, the young passing within the marsupium of the female through one or more so-called pupa-stages before being hatched. In the Euphausiidæ, however, a totally different mode of development has been discovered, the young of these animals being hatched in a very immature condition, and not attaining, till after an exceedingly complicated free metamorphosis, the form characteristic of the adults.

The Schizopoda occupy, as it were, the most primitive position within the division of the Podophthalmia, being apparently the least modified forms, in which the original characters distinguishing the progenitors of the whole division would seem to exhibit least change. This view derives, too, undeniable confirmation from the fact that a vast number of the higher Podophthalmia (Macrura, Caridea) pass during development through a larval stage—the so-called Mysis-stage—calling to mind in a most striking manner the Schizopod type.

The suborder Schizopoda, as far as at present known, may be divided into four natural sections or families, viz., the Lophogastridæ, Eucopiidæ, Euphausiidæ, and Mysidæ. These families are comparatively well defined, exhibiting on the whole very marked differences, both in the external appearance and in several of the anatomical details, and also partly in development.

The most highly organised Schizopoda are undoubtedly the Lophogastridæ, whereas the lowest forms are comprised within the family Mysidæ. The Eucopiidæ would appear on the whole—notwithstanding the peculiar structure of the legs—to be those most nearly related to the Lophogastridæ. Somewhat more divergent are the Mysidæ, which form an exceedingly rich and at the same time well-defined group of Schizopoda. The fourth family, the Euphausiidæ, occupies in many respects rather an isolated position within the suborder; thus, the many remarkable peculiarities distinguishing these forms have led Dr. Boas[1] to exclude them wholly from the Schizopoda, and to establish for their reception a perfectly distinct order, which, in the opinion of that author, is the one most nearly allied to the remarkable and anomalous Crustacean *Nebalia*. Although in most points I fully entertain the views set forth in the very interesting treatise of Dr. Boas on the affinity of the higher Crustacea, and also admit the significance of the divergencies distinguishing the Euphausiidæ from both the Mysidæ and the Lophogastridæ, I am by no means prepared to agree with him in excluding these families from the Schizopoda. In their whole external form and appearance they are true Schizopods, whereas in these respects they do not show any resemblance to the genus *Nebalia*. This form, too, in my opinion ought to be retained within the order Branchiopoda, representing there, however, a separate section or suborder (Phyllocarida), which in some respects exhibits a perplexing affinity to higher types of Crustacea.

[1] Studien über die Verwandtschaftsbeziehungen der Malacostraken, *loc. cit.*

DEFINITIONS OF THE FAMILIES.

The four families of Schizopoda above mentioned may be briefly characterised as follows :—

1. Lophogastridæ.

Carapace rather large, more or less calcareous; its posterior part but loosely covering the trunk, all segments of which are well defined dorsally. Maxillipeds robust, with the exopodite imperfectly developed, the epipodite very large and projecting within the branchial cavity. First pair of legs more or less distinctly modified as gnathopoda, remaining pairs uniform and ambulatory, with well-marked dactylus. Branchiæ (arthrobranchiæ) very complex, arborescent, consisting of three or four principal branches, the innermost largest and freely projecting beneath the trunk, the remaining branches covered by the carapace, posterior pair rudimentary or wanting. Marsupium in female composed of seven pairs of incubatory plates. Caudal limbs well developed in both sexes and of uniform structure, natatory. Development without any free metamorphosis.

Genera.

1. *Lophogaster*, M. Sars.
2. *Ceratolepis*, G. O. Sars.
3. *Gnathophausia*, Suhm.
4. *Chalaraspis*, Suhm (*ex parte*).

2. Eucopiidæ.

Carapace very large, membranous, the lateral wings produced and projecting over the base of the tail. Segments of trunk all well defined. Maxillipeds nearly the same as in the Lophogastridæ. Legs dissimilar in structure, the three anterior pairs modified to serve as gnathopoda, the three succeeding pairs extremely slender, filiform, with the dactylus falciform and very mobile, last pair simple, not prehensile. Branchiæ, marsupium, and caudal limbs nearly the same as in the Lophogastridæ. Development ?

Genus.

Eucopia, Dana.

3. Euphausiidæ.

Carapace rather small, not calcareous, firmly connected with the trunk along the dorsal face, leaving only part of the last segment closed above. Maxillipeds elongate, pediform, with the exopodite well developed, natatory, the epipodite rudimentary or wanting.

Legs generally uniform in structure, not adapted for walking, geniculate and densely setose, without any distinct dactylus; posterior pairs more or less imperfectly developed. Branchiæ (podobranchiæ) wholly uncovered, digitiform-arborescent, the posterior pairs rather complex, sending off a branch beneath the trunk. Egg-pouch, when present, placed beneath posterior part of trunk, single or double, not formed by any incubatory lamellæ. Caudal limbs strongly developed in both sexes, natatory, inner plate provided with a secondary lobe, and in the male modified on the first two pairs as copulative organs. Luminous globules of complicated structure generally present on both the anterior and posterior divisions of the body. Propagation by means of spermatophores. Development very complex, the free larva passing through the Nauplius and Zoëa-stages.

Genera.

1. *Euphausia*, Dana.
2. *Thysanopoda*, M.-Edw.
3. *Bentheuphausia*, n. gen.
4. *Nyctiphanes*, G. O. Sars.
5. *Boreophausïa*, n. gen.
6. *Thysanoëssa*, Brandt.
7. *Nematoscelis*, G. O. Sars.
8. *Stylocheiron*, G. O. Sars.

4. Mysidæ.

Carapace generally rather small; its posterior part only loosely covering the trunk, the segments of which are distinctly defined, although very narrow and crowded together in the dorsal part. Maxillipeds strong, with the exopodite well developed, natatory, epipodite lanceolate and projecting within the branchial cavity. First pair of legs modified as gnathopoda, the remaining legs uniform and generally of rather feeble structure, the terminal part being in most cases subdivided into short setiferous articulations, the dactylus, as a rule, small or wanting. No true branchiæ present. Marsupium in most of the genera composed of only two or three pairs of incubatory lamellæ, issuing from the bases of the hindmost pair of legs. Caudal limbs in female quite rudimentary, not adapted for swimming; in male either natatory or some of them modified to serve as copulative organs. Inner plate of uropoda generally containing within its base a peculiarly developed auditory apparatus. Development without any free metamorphosis.

Genera.

1. *Petalophthalmus*, Suhm.
2. *Boreomysis*, G. O. Sars.
3. *Amblyops*, G. O. Sars.
4. *Pseudomma*, G. O. Sars.
5. *Erythrops*, G. O. Sars.
6. *Parerythrops*, G. O. Sars.
7. *Anchialus*, Kröyer.
8. *Mysidopsis*, G. O. Sars.
9. *Leptomysis*, G. O. Sars.
10. *Siriella*, Dana.
11. *Mysideis*, G. O. Sars.
12. *Promysis*, Dana.
13. *Euchætomera*, G. O. Sars.
14. *Hemimysis*, G. O. Sars.
15. *Mysis*, Thompson.
16. *Macropsis*, G. O. Sars.
17. *Mysidella*, G. O. Sars.
18. *Heteromysis*, Smith.

LIST OF THE SPECIES.

The following is a list of the species of Schizopoda procured during the Challenger Expedition :—

Lophogastridæ.

1. *Lophogaster typicus*, M. Sars.
2. *Ceratolepis hamata*, G. O. Sars.
3. *Gnathophausia ingens* (Dohrn).
4. „ *gigas*, Suhm.
5. „ *calcarata*, G. O. Sars.
6. „ *willemoesii*, G. O. Sars.
7. „ *affinis*, G. O. Sars.
8. „ *elegans*, G. O. Sars.
9. „ *zoëa*, Suhm.
10. „ *longispina*, G. O. Sars.
11. „ *gracilis*, Suhm.
12. *Chalaraspis alata*, Suhm, M.S.

Eucopiidæ.

13. *Eucopia australis*, Dana.

Euphausiidæ.

14. *Euphausia pellucida*, Dana.
15. „ *similis*, G. O. Sars.
16. „ *splendens*, Dana.
17. „ *murrayi*, G. O. Sars.
18. „ *superba*, Dana.
19. „ *antarctica*, G. O. Sars.
20. „ *mucronata*, G. O. Sars.
21. „ *gracilis*, Dana.
22. „ *gibba*, G. O. Sars.
23. „ *spinifera*, G. O. Sars.
24. „ *latifrons*, G. O. Sars.
25. *Thysanopoda tricuspidata*, M.-Edw.
26. „ *obtusifrons*, G. O. Sars.
27. „ *cristata*, G. O. Sars.
28. *Thysanopoda microphthalma*, n. sp.
29. *Bentheuphausia amblyops*, G. O. Sars, n. gen.
30. *Nyctiphanes australis*, G. O. Sars.
31. *Thysanoëssa gregaria*, G. O. Sars.
32. „ *macrura*, G. O. Sars.
33. *Nematoscelis megalops*, G. O. Sars.
34. „ *microps*, G. O. Sars.
35. „ *tenella*, G. O. Sars.
36. „ *rostrata*, G. O. Sars.
37. *Stylocheiron carinatum*, G. O. Sars.
38. „ *suhmii*, G. O. Sars.
39. „ *longicorne*, G. O. Sars.
40. „ *elongatum*, G. O. Sars.
41. „ *abbreviatum*, G. O. Sars.

Mysidæ.

42. *Petalophthalmus armiger*, Suhm.
43. *Boreomysis scyphops*, G. O. Sars.
44. „ *obtusata*, G. O. Sars.
45. „ *microps*, G. O. Sars.
46. *Amblyops crozetii*, Suhm, M.S.
47. „ *australis*, G. O. Sars.
48. *Pseudomma sarsii*, Suhm, M.S.
49. *Anchialus typicus*, Kröyer.
50. „ *angustus*, G. O. Sars.
51. „ *pusillus*, n. sp.
52. *Mysidopsis* (?) *incisa*, G. O. Sars.
53. *Siriella thompsonii*, M.-Edw.
54. „ *gracilis*, Dana.
55. *Euchætomera typica*, G. O. Sars.
56. „ *tenuis*, G. O. Sars.
57. *Heteromysis bermudensis*, n. sp.

DESCRIPTION OF GENERA AND SPECIES.

Order PODOPHTHALMIA.

Suborder SCHIZOPODA.

Family 1. Lophogastridæ.

This family, formerly represented only by a solitary genus, *Lophogaster*, has acquired a very considerable augmentation by the material collected during the Challenger Expedition, three interesting new genera having been added, one of which (*Gnathophausia*) is represented by no less than nine different species.

I have placed this family at the head of the suborder, since it would seem to comprise the most highly organised forms of Schizopoda. This may easily be shown by comparing the structure and development of the several organs with the corresponding ones in other Schizopods, and especially by examining the branchial apparatus, the highly differentiated structure of which gives full evidence of the high rank occupied by these forms. The fact that by far the largest and most powerfully developed species are to be found in the present family, would seem also to support such a view.

The late Professor M. Sars, my father, had already stated that the genus *Lophogaster*, which constitutes the type of this family, exhibits in several respects a striking affinity to some of the lower Macrura (Caridea). Exclusive of the strong development of the gills, may also be noted the structure of the integuments, which are more or less calcified or indurated, and in some cases even exhibit a distinctly perceptible sculpture, not to be found in any other Schizopods; moreover, the comparatively powerful structure of the legs renders those organs apparently more efficient for the office of true pereiopoda, than is the case with the other known forms of this suborder. From the Macrura they may, however, be easily distinguished, not only by the incubatory pouch of the females, but also by the uniformly developed biramous legs, none of which exhibit any trace of a cheliform or even subcheliform structure.

A synopsis of the four genera comprised in this family is given below :—

Carapace
- covering only the anterior division of the body. Rostrum
  - short, forming together with the supra-orbital spines a broad tridentate frontal plate. Antennal scale
    - broad, cordiform, with the inner edge setose, . . . *Lophogaster.*
    - narrow, flexuous, without marginal setæ, . . . *Ceratolepis.*
  - more or less produced, spear-shaped, denticulate, *Gnathophausia.*
- covering whole of the anterior division of the body and part of posterior, . *Chalaraspis.*

Genus 1. *Lophogaster*, M. Sars, 1856.

Lophogaster, M. Sars, Forhandl. Skand. Naturf., Möde i Christiania, 1856, p. 160.
Ctenomysis, Norman, Rep. Brit. Assoc., 1861, p. 151.

Generic Characters.—Carapace distinctly sculptured, forming anteriorly a broad tridentate frontal plate, posterior margin deeply emarginate in the middle, leaving last segment of trunk wholly exposed above, lateral wings produced, pointed. Caudal segments with well-defined lamellar epimera, last segment subdivided by a transverse suture. Eyes globular, partly covered by the frontal plate. Antennular peduncle very short and thick, inner flagellum small, outer remarkably strong and elongate. Antennal scale cordiform, outer edge serrate, inner setose. First pair of maxillæ without any palp, second pair with only two masticatory lobes; palp comparatively small. First pair of legs (gnathopoda) with terminal joint obtusely rounded and densely hirsute. The remaining legs rather robust, with strongly developed dactylus. Branchiæ tripartite, the branches regularly bipinnate, and each pinnula exhibiting a double series of small leaflets. Telson produced, with apex entire, and armed with strong terminal spines. Outer plate of uropoda not subdivided at extremity, outer edge straight, and terminating in a small dentiform projection.

Remarks.—In the above diagnosis I have made an attempt to arrange together several characters, that in my opinion should be regarded as peculiar to the present genus, when compared along with the three new genera brought to light by the Challenger Expedition. The genus which, as that first established, may be taken to be the type of the family, is as yet represented only by a single species, *Lophogaster typicus*, formerly regarded exclusively as a northern form, but now having also been met with during the Challenger Expedition, proved to exhibit a very wide geographical distribution.

1. *Lophogaster typicus*, M. Sars (Pl. I. figs. 1–7).

Lophogaster typicus, M. Sars, Forhandl. Skand. Naturf., Möde i Christiania, 1856, p. 160.
Ctenomysis alata, Norman, Rep. Brit. Assoc., 1861, p. 151.
Lophogaster typicus, M. Sars, Univ. Progr., 1862.

Of this interesting Schizopod, fully described by the late Professor M. Sars, there are three more or less complete specimens in the Challenger collection, from two Stations, at no great distance apart, both south of the Cape of Good Hope. One of the specimens is a full-grown male, the other two (one of which is defective) are females.

I have most carefully compared these specimens with the form occurring on the Norwegian coast, without, however, having detected any distinctive character warranting the assignment of specific difference, and hence I am obliged to regard them as belonging to the typical species, notwithstanding the remarkable fact of their occurrence in a locality so widely distant from the Norwegian Sea.

To show the correctness of this assumption, and at the same time afford other zoologists an opportunity of instituting a comparison, I have given on the first Plate of the present Report figures of the Challenger specimens, and subjoin the following descriptive notes.

The male specimen (fig. 1) has a length of 25 mm., and is distinguished from the female (fig. 2) by a somewhat more powerful development of the tail, as also by the greater length of the outer antennular flagellum.

The broad frontal plate, which is hollowed in the centre (fig. 3), has the median tooth (rostrum) rather short, not exceeding in length the lateral teeth (supra-orbital spines), and covers, as in the Norwegian form, not only a great part of the antennular peduncles, but also the bases of the globular eyes, forming here a kind of imperfect orbit.

The antennal scale (fig. 3) exhibits the peculiar cordiform shape characteristic of the species, but in the present specimen is distinguished by the unusually small number of teeth (only three) on the outer margin.

Having examined a series of Norwegian specimens, I find, however, that the number of teeth along the outer edge of the antennal scale, as well as the relative length of the teeth on the frontal plate, is subject to a rather considerable variation. This, too, is obvious on comparing the male specimen here described with the two other specimens procured from the Challenger Expedition, which are both females.

One of these females, the most perfect, is represented in fig. 2, viewed from above. It has a length of 18 mm., and thus is somewhat smaller than the male specimen, a fact in accordance with that observed in the Norwegian forms, the females of which are, as a rule, considerably smaller than the adult males.

It will be observed, that the median tooth of the frontal plate in this specimen is rather more produced than the lateral teeth, reaching almost to the end of the antennular peduncle. Moreover, the number of teeth along the outer edge of the antennal scale (fig. 4) is greater, as many as five having been counted.

Of the legs, I have figured one belonging to the last pair (fig. 5) in the imperfect female specimen. On comparing this figure with the one given by my father of the same leg in a Norwegian specimen[1] the resemblance between the two is very striking.

The caudal fan (fig. 6) also exhibits in all its details the most perfect agreement with that of the Norwegian form. The telson, considerably exceeding in length the uropoda, is scooped out dorsally along the middle, exhibiting two parallel longitudinal carinæ, most prominent in the posterior part. It tapers gradually towards the apex, and, a little posterior to the middle, is provided on either side with three small lateral denticles. To the truncate extremity of the telson are attached four strong spines, and a little anterior to them is observed another somewhat smaller spine on either side. In

[1] See Univ. Progr., pl. ii. fig. 36.

the middle, between the two larger apical spines, projects moreover a thin and finely serrate lamella, to the lower side of which are attached two delicate diverging bristles. This serrate lamella is not figured distinctly in the work of the late Professor M. Sars, although it is mentioned in the text. However, on re-examining the Norwegian form I have found it to be present, and in form and armature of precisely the same appearance as in the specimen here figured (fig. 7).

Habitat.—The specimens procured by the Challenger Expedition were collected at the following Stations :—

Station 141, December 17, 1873 ; lat. 34° 41′ S., long. 18° 36′ E.; depth, 98 fathoms; green sand ; bottom temperature, 49°·5.

Station 142, December 18, 1873 ; lat. 35° 4′ S., long. 18° 37′ E.; depth, 150 fathoms; green sand ; bottom temperature, 47°·0.

The present species occurs rather abundantly along the southern and western coasts of Norway at a depth of from 20 to 100 fathoms, and has also been recorded from the Shetland Isles by the Rev. Dr. Norman (= *Ctenomysis alata* of that author).

It may be regarded as a true bottom-form, never having been found at the surface of the sea, as is the case with some other Schizopods.

Distribution.—Concerning the geographical distribution of the species, the occurrence of this form in the southern hemisphere, as shown by the Challenger collection, is remarkable, and might induce the belief that it ranges from the Norwegian Sea along the whole western coast of Europe and Africa, or throughout the boreal, lusitanic, tropic, and antiboreal regions. It may, however, be considered as a highly remarkable fact, that this very striking form has never been recorded either from the coasts of England and France, or from the Mediterranean, although each of these tracts has been carefully investigated by numerous zoologists. We may therefore entertain the assumption that this form in reality does not occur throughout the intermediate tracts of the ocean, but is met with independently in both hemispheres in the corresponding region. Should this be the case, we may infer that the distribution of the species must at an earlier date have been continuous, but considerable changes afterwards occurring in the physical conditions led to a separation of the species into two independent stocks. In the sequel we shall meet with another still more striking example of a similar kind, in treating of the Mysidian *Boreomysis scyphops*, a form stated to occur in the Arctic and Subantarctic regions only, having never yet been found in any intervening tract.

Genus 2. *Ceratolepis*, G. O. Sars, 1883.

Ceratolepis, G. O. Sars, Preliminary Notices on the Challenger Schizopoda.

Generic Characters.—Carapace highly indurated and very large, covering the whole of the anterior division of the body, posteriorly abruptly truncate, not emarginate, anteriorly forming a broad tridentate frontal plate, as in *Lophogaster*. Caudal segments comparatively short and narrow, with small epimera; the last not subdivided by any transverse suture. Antennulæ similar to those of *Lophogaster*. Antennal scale very peculiar, forming a narrow flexuous plate of firm consistence, without any trace of marginal bristles. Legs of comparatively more feeble structure than in *Lophogaster*, first pair modified so as to form gnathopoda, last pair (in female) without natatory branches. Telson bifid, without distinctly articulated spines. Uropoda very small, the terminal plates uniform, lanceolate and setose on both margins.

Remarks.—This new genus is obviously rather closely related to *Lophogaster*, differing however, in addition to other characters, very distinctly in the form of the carapace, the very remarkable structure of the antennal scale, the want of distinctly developed exopods on the last pair of legs, and finally in the structure of the telson and uropoda. The genus comprises at present but a single species, of which a solitary specimen only was collected by the Expedition.

2. *Ceratolepis hamata*, G. O. Sars (Pl. I. figs. 8–17).

Ceratolepis hamata, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 2.

Specific Characters.—Form of body rather short and robust. Carapace slightly nodulose above, with the dorsal area distinctly marked. Median tooth of the frontal plate conically produced, and reaching to the end of the antennular peduncle, lateral teeth much shorter and somewhat deflexed. Epimera of the caudal segments finely serrated on the posterior margin. Last segment jutting out posteriorly into four rather large projections, two lateral and two terminal, the latter embracing the base of the telson. Eyes rather small, almost wholly covered above by the frontal plate. Antennal scale considerably projecting in front of the antennular peduncle, slightly curved outward and somewhat dilated at the apex, forming there two acute angles, the one pointing forward, the other recurved in the shape of a hook; internal margin angular in the middle. Telson deeply cleft at the apex, terminal lobes acuminate and diverging. Length, 12 mm.

Remarks.—The species here treated of being the only one yet established in the genus *Ceratolepis*, it is no easy matter to decide with certainty what characters should be regarded as of specific significance. I have, however, sought in the above diagnosis to adduce some few distinctive peculiarities, that may perhaps be of weight in this respect.

Description.—The specimen examined is a female, and may be assumed to be nearly full grown, since the incubatory lamellæ are distinctly perceptible beneath the trunk, though still rather small, and not as yet forming any marsupium. The length, too, of the animal does not exceed 12 mm., and hence this form would appear to be the smallest of the known Lophogastridæ.

The general form of the body (see figs. 8 and 9) is comparatively short and thickset, resembling on the whole that of *Lophogaster*, with this difference, however, that the anterior division, owing to the strong development of the carapace, appears somewhat larger when compared with the posterior.

Contrary to what is usually found to be the case in Schizopods, the integuments are remarkably firm and highly indurated, giving to the whole body a peculiar rigidity, somewhat resembling the higher forms of Macrura.

The carapace is of very considerable size, fully equalling in length the tail, if the telson be excluded. It completely covers the whole anterior division of the body in such a manner that none of the segments of the trunk are dorsally exposed. Its surface is rather uneven, exhibiting, more particularly in the upper part, a peculiar rugged or wrinkled aspect (see fig. 8). A distinctly impressed line marks off above, as in *Lophogaster*, a somewhat linguiform dorsal area, terminating about the beginning of the posterior fourth of the carapace. Posteriorly to this area, and laterally, the carapace covers the trunk but loosely, whereas within the area it forms the immediate wall of the body. Anteriorly, the carapace projects as a broad, horizontally extending frontal plate, covering the eyes and a great part of the antennular peduncles, as in *Lophogaster*. This plate juts out in the middle as a conical process, reaching to the end of the antennular peduncle, and more properly answering to the rostrum. The lateral edges of the frontal plate (the supraorbital spines) form similar processes, though somewhat shorter and more deflexed (see fig. 8). The inferior margins of the carapace are but very slightly arcuate, and terminate anteriorly almost in a right angle. The posterior margin, too, is abruptly truncate, not as usual emarginate in the middle, and the lateral wings of the carapace do not project at all posteriorly.

The posterior division of the body, or tail, is comparatively short and narrow, exhibiting dorsally a similar rugged appearance to the carapace, the median part of every segment being rather convex, whereas at both extremities a distinctly perceptible transverse impression occurs. The epimera are rather small, of an obtusely triangular form, and finely serrated at the posterior margin toward the apex (fig. 16). The first segment has on either side an anteriorly pointing projection, fitting in beneath a short corresponding lateral keel on the posterior part of the carapace when the tail is fully extended (see fig. 8). The last segment is not much longer than the preceding, but rather narrower. It has no trace whatever of the transverse suture observed in *Lophogaster*, but exhibits posteriorly on either side a strong

triangular projection, as also two posteriorly curved mucroniform spines, embracing the base of the telson.

The eyes (see fig. 10) are comparatively small, and almost wholly covered above by the frontal plate, without, however, being lodged, as it were, within orbital hollows, as in *Lophogaster*. The cornea occupies a comparatively small part of the eyes, and does not exhibit any appreciable dilatation; its pigment is dark, and the visual elements are normally developed.

The antennular peduncle (fig. 11, a^1) is short and thick, not, however, to such an extent as in *Lophogaster*. The last joint does not exceed the basal in length, while in *Lophogaster* it is even larger than the two remaining joints taken together. As in the latter genus, the basal joint is somewhat applanated, and projects exteriorly as a pointed lappet. Of the flagella, the inner is very small, scarcely more than half as long as the peduncle, and composed of rarely more than ten short articulations. The outer flagellum, too, would seem to have been much more strongly developed, but its length cannot be exactly stated, the terminal part having been broken off in the specimen examined.

The basal part of the antennæ (see fig. 11) is thick and highly chitinised, forming on the external side a keeled prominence. The terminal part (a^2) is of the same structure as in *Lophogaster*. On the other hand, the scale (fig. 11, *sq*; fig. 12) exhibits a totally different and very peculiar appearance. It is almost twice as long as the antennular peduncle, and has the form of a very narrow, strongly chitinised, and somewhat flexuous plate, without any trace of the usual marginal bristles, but provided with several strong angular projections. The exterior part of the plate is rather prominently curved outwards and somewhat dilated at the apex, which projects in two acute angles, the one pointing straight forward, the other recurved in the shape of a hook. In the middle, the inner edge of the plate forms a similar recurved projection, and in front of this may be observed another short angular prominence. As regards both form and structure, this scale is wholly dissimilar to anything observed in other known Podophthalmia, and hence it undoubtedly represents one of the features most characteristic of the genus.

Concerning the oral parts, they would appear, on the whole, so far as they admit of being examined in the only specimen obtained, to agree with those in *Lophogaster*. Viewed from below (fig. 11), the following parts may be more or less distinctly observed within the comparatively very broad buccal area; anteriorly, on the median line appears the galeate anterior lip (*L*), and on each side the mandibles (*M*), with their palps (*p*), which are very elongate and slender; posterior to the mandibles are the maxillæ, of which, however, only the second pair admit of being partly examined, their exognaths (m^2) being wholly exposed and rather large, elliptic, and fitting into a semicircular opening, that leads to the branchial cavity; they are as usual fringed with a row of strong ciliated bristles. The maxillipeds (*mp*) marking off posteriorly the buccal area,

exhibit a structure perfectly similar to that in *Lophogaster*, the exopodite here also being imperfectly developed, forming only a very small setous lamella (*x*).

The first pair of legs (fig. 13), as in *Lophogaster*, differ perceptibly from the remaining pairs, being somewhat more robust in structure, and having the terminal joint not unguiform, but of an oval shape, and densely beset with bristles. Hence this pair may properly be regarded as true gnathopoda.

The remaining legs (fig. 14) are all true pereiopoda, but have comparatively a more feeble structure than in *Lophogaster*, with the carpal joint more elongate, whereas the terminal one, or dactylus, is much shorter.

The last pair of legs (fig. 15) are chiefly distinguished by the want of natatory branches or exopods, in the place of which only a diminutive setous tubercle is to be seen. This, however, may perhaps be a characteristic peculiar to the females.

The caudal limbs (see fig. 8) are normally developed, and do not seem to differ essentially in structure from those in *Lophogaster*.

The telson (fig. 17) somewhat exceeds in length the two preceding segments taken together, and exhibits a form similar to that in *Lophogaster*, but differs materially in the apex not being entire but deeply cleft, or produced into two acuminate and diverging lappets, somewhat resembling the tail of a swallow. The inner edge of these terminal lappets is indistinctly serrated. For the rest every trace of spines or bristles is entirely wanting.

The uropoda (fig. 17) are most unusually small, being scarcely half as long as the telson, and with both their terminal plates of a uniform appearance, lanceolate, and setose on both margins.

Habitat.—The solitary specimen described above I found in a small bottle containing Euphausiidæ, larvæ of Macrura, and certain other pelagic animals, all of which, as shown by the label, were collected at the surface of the sea in the Pacific Ocean, between Api (New Hebrides) and Cape York (Australia).

This occurrence, certainly, is very remarkable, since none of the other Lophogastridæ are known to lead a pelagic existence. Indeed, judging from the organisation of the present species, and more especially the very firm and highly indurated integuments, one would indeed be induced to regard it as still more decidedly a bottom form than most of the other Schizopods.

Genus 3. *Gnathophausia*, Willemoes-Suhm, 1879.

Gnathophausia, Suhm, Trans. Linn. Soc. Lond., ser. 2, vol. i.

Generic Characters.—Integuments generally not very firm, parchment-like. Carapace rather large, in the greater part of its length only loosely covering the trunk, and exteriorly provided with raised longitudinal keels. Rostrum more or less elongate and

slender, spear-shaped, three-edged, denticulate. Hinder part of carapace for the most part drawn out dorsally into a posteriorly pointing spine. Caudal segments narrow, with small, bilobed epimera; the last subdivided transversely. Eyes well developed, with a small papilla issuing from the pedicle anteriorly. Antennular peduncle short and thick, outer flagellum greatly produced, riband-shaped. Antennal scale of somewhat varying form in different species. First pair of maxillæ provided with a biarticulate, setous palp, completely recurved posteriorly. Second pair exhibiting at the base exteriorly a pigmented protuberance (luminous organ?); anterior masticatory lobe cleft to the base into two very narrow lappets; palp rather large. Maxillipeds having exopodite either very small or entirely wanting. Legs slender, nearly uniform, ambulatory; first pair differing very slightly from the rest. Branchiæ divided into four bipinnate ramifications, pinnulæ exhibiting irregularly disposed, digitiform lobules. Telson very large, constricted near the base, lateral edges densely spinulous, apex armed with two strong curved spines connected at the base. Uropoda with the outer plate broader than the inner, and having a short dentiform projection at the end of the outer margin, the terminal lobe being marked off by a distinct transverse suture.

Remarks.—Of the earlier known Schizopods, *Lophogaster* certainly comes nearest to the present interesting genus, first established by the late Dr. v. Willemoes-Suhm, and I fully agree with that author in including it in the same family with that genus. On the other hand, it will appear from the diagnosis given above, that the genus here treated of exhibits several very striking features, distinguishing it rather clearly from the other Lophogastridæ. Moreover, the general appearance will be found to diverge a good deal from that observed in the two preceding genera.

To our knowledge of the present remarkable genus a very important contribution has been furnished by the Challenger Expedition, no less than nine different species being represented in the collection. Of these species, only one, *Gnathophausia ingens*, had been recorded at an earlier date; all the remaining species were first discovered during the course of the Expedition.

With a view of obtaining a clearer survey of the organisation of this interesting type, I have deemed it advisable to give a general description of the genus, previously to characterising the several species comprised therein.

General Description of the Genus.—The form of the body (see figures given in Pls. II. to VII.) will be found to vary somewhat in the different species, mainly owing to the more or less prominent development of the carapace. In all the species, however, the tail is very slender, almost cylindrical in form, and its segments provided with rather small epimera, divided into two more or less produced lappets. The last segment exhibits, as in *Lophogaster*, an obliquely transverse suture, thus apparently subdividing it into two sections, the anterior of which is provided with a pair of imperfectly developed, and, in some species very peculiarly formed, epimera.

The carapace in all the species is rather large, almost covering the whole anterior division of the body, not, however, being connate, only to a rather limited extent. When viewed from above it exhibits anteriorly (see Pls. II., III., IV., V. fig. 2) a short linguiform area, sharply marked off behind by a curved line. This dorsal area projects from the so-called stomachal region, and generally does not even reach posteriorly the middle of the carapace. Only within this restricted area, and in front of it, does the carapace constitute the true body-wall; behind it covers, though very loosely, the trunk, all the segments of which appear well developed in their whole circumference, and exhibit a rather uniform aspect (see Pl. VIII. fig. 17). Thus the greater part of the carapace, as in the genus *Nebalia*, would appear to form, so to speak, merely a loose mantle arching the back and sides of the trunk, and within which the body is freely movable; a character also regarded by the late Dr. v. Willemoes-Suhm as more particularly distinguishing the present type. This mantle-like portion of the carapace, likewise found, though generally less prominently developed, in the other Lophogastridæ, as also in *Eucopia* and in the Mysidæ, exhibits in *Gnathophausia* on each side two more or less well-marked longitudinal keels, dividing this part into five areas, the odd one in the middle, limited by both of the upper keels, with a lateral area on each side, between the upper and lower keels, finally a much smaller marginal area, extending between the lower keel and the free edge of the carapace, the last being strongly inflected toward the ventral face. The lateral areas occupying most of the sides of the carapace, are bounded anteriorly by an obliquely descending elevated line, corresponding, in position, with the branchiostegal line of the higher Podophthalmia, and terminating just above the buccal area. Immediately below this line, the carapace forms a more or less marked lateral expansion, jutting out in some species into a strong, exteriorly pointing projection, which I regard as the branchiostegal spine.

Viewed from below (see Pl. IV. figs. 3 and 4), the free margins of the carapace will be found to exhibit on each side a deep, nearly semicircular emargination, into which the exognath of the second pair of maxillæ fits. Moreover, this emargination is bounded anteriorly as well as posteriorly by an obtuse linguiform lobe bent inwards; the anterior lobe partly overlaps the body of the mandible, whereas the posterior lobe inclines toward the base of the maxillipeds. Immediately anterior to the above mentioned lateral expansion of the carapace, a strong spine projects in most of the species, pointing obliquely forward, which, as to its position on the side of the basal part of the antennæ, may properly be regarded as the antennal spine. Finally, just above the eyes, or on each side of the base of the rostrum, the frontal part of the carapace usually juts out into a similar, and often rather strongly developed spine, undoubtedly corresponding to the supraorbital spine in other Podophthalmia.

The rostrum is generally rather elongate and slender, though sometimes very broad

at the base, spear-shaped, more or less straight and horizontally projecting, and terminating in a sharp point. It has, also, three denticulate keels, one dorsal and two lateral, a transverse section thus exhibiting a triangular form. Moreover, the dorsal keel of the rostrum is produced posteriorly along the upper face of the carapace, being, however, in some species interrupted in the middle part. It always reappears in the hindmost region of the carapace, generally running out here as a more or less produced, posteriorly directed, spine (the dorsal spine). The lateral wings of the carapace, too, in some few species are produced as similar posteriorly pointing spines, very highly developed in the form described below as *Gnathophausia calcarata* (see Pl. IV.); in most of the species, however, these parts are evenly rounded off.

The eyes in all known species are distinctly developed, although of somewhat variable form, being sometimes very narrow, sometimes strongly dilated at the end, or pyriform. On the upper side of the pedicle is invariably to be observed a small papillar prominence (the ocular papilla). The eye-pigment is of a dark colour, and the visual elements would seem to be normally developed.

The antennular peduncle (see Pl. VIII. fig. 1) is rather short and thick, though somewhat less so than in the two preceding genera. The basal joint is slightly flattened, and projects on the outer side at the apex as an obtuse bristle-beset angle. The second joint is very short, almost discoidal, with an elevated crest running transversely over the upper side. The last joint, almost square in form, exhibits internally a sharpened edge, that runs out anteriorly as a linguiform lobe fringed with strong ciliated bristles. On the upper side of this joint, as in the Mysidæ, between the insertion of the flagella, occurs a small scale-like projection, furnished with three delicate diverging bristles. Of the flagella, the inner one is rather narrow, filiform, and of moderate length. On the other hand, the outer one is most remarkably developed, as a rule equalling the whole body in length; it is distinctly compressed throughout, indeed almost riband-shaped, and furnished with a dense fringe of sensory bristles along one of its margins.

The basal part of the antennæ (see Pls. II., III. fig. 4; Pl. IV. fig. 5; Pl. V. figs. 4 and 9; Pl. VI. figs. 3 and 9; Pl. VII. figs. 3 and 8) is, as usual, rather thick and massive, consisting of three segments, most distinctly defined below, the last of which runs out externally as a compressed projection. The terminal part nearly equals in length the inner antennular flagellum, its peduncle being rather small and divided into three articulations, of which the last is the largest. The scale exhibits a somewhat different appearance in the different species. Thus, in the three species, *Gnathophausia ingens*, *Gnathophausia gigas*, and *Gnathophausia calcarata*, it is very small and in form somewhat resembles that of *Lophogaster*, whereas in the remaining species its structure is more in accordance with that usually met with in the Caridea.

The anterior lip (Pl. IV. fig. 4, *L*; Pl. VIII. fig. 2, *L*) forms a somewhat galeate or triangular, fleshy prominence, placed posteriorly to the short epistome, at the anterior part

of the buccal area, and partly covering with its sharp posterior edge the masticatory parts of the mandibles.

The posterior lip (Pl. VIII. fig. 5) consists of two membranous and somewhat expanded lobes, connate in the greater part of their length, and exhibiting anteriorly a fringe of delicate cilia.

The mandibles (Pl. IV. fig 4, *M;* Pl. VIII. figs. 2, 3) are strongly developed, with the body evenly arched externally, and navicular in form. The cutting edge is armed with strong dentiform projections of a somewhat irregular form, and exhibits in its posterior part a distinctly fluted molar surface. As is usually the case, the armature is somewhat unequal on the right and left mandibles (Pl. VIII. fig. 2). The palp is rather large, densely setose, and consists of three joints, the first quite short, the second comparatively elongate and strongly compressed, the last rather narrow, and provided along the inner sharp edge, almost throughout its whole length, with a dense fringe of delicate spines, disposed in a pectinate arrangement, besides which it has a row of fine bristles (see fig. 3).

The first pair of maxillæ (Pl. VIII. fig. 6) exhibit, as in *Lophogaster*, two incurving masticatory lobes, of which the outer is the larger, and armed at the truncated apex with short spines, whereas the inner lobe is more membranous in structure, and densely beset with ciliated bristles. These maxillæ, however, are readily distinguished by the presence, on the outer side of the basal part, of a distinctly developed two-jointed palp, which, contrary to what is the case in other Podophthalmia, is bent directly backward, so as to project into the branchial cavity, thus acquiring at the first glance the appearance of an epignath. Both joints of this palp are beset with long and thin bristles, of which more especially those attached to the ovoid terminal joint are of very considerable length; all these bristles are armed at one of their edges with fine spinules. Regarding the function of this very peculiar palp, it certainly may be deemed similar to that observed in the corresponding part of Cumacea and the cheliferous Isopoda, viz., to cleanse the branchial cavity from foreign particles.

The second pair of maxillæ (Pl. IV. fig. 4, m^2; Pl. VIII. fig. 7) are rather large, expanded into lamellæ, and exhibit exteriorly at the base a very conspicuous mamilliform prominence (x), within which, in spirit specimens, is observed an opaque, finely granular matter. As stated by the late Dr. v. Willemoes-Suhm, this prominence in fresh specimens is vividly coloured, and has been regarded by that author as a kind of visual organ ("accessory eye"); hence the generic denomination *Gnathophausia*. I have, however, failed to trace any refracting elements within this prominence, and hence am inclined to regard it rather as a kind of phosphorescent organ. The basal part sends off internally, as in *Lophogaster*, two masticatory lobes, pointing obliquely forward, of which, however, the anterior is deeply cleft, almost to the base, forming two very narrow lappets, provided, in addition to the usual apical spines, with a transverse row of stiff bristles at some distance from the apex. The posterior masticatory lobe is rather

broader, linguiform, and provided along the inner margin with a double row of delicate curving bristles. The distal portion of the basal part is marked off as a distinct segment, furnished interiorly with a fascicle of bristles, whereas exteriorly, between the palp and the exognath, it runs out as an obtusely rounded prominence. The palp is comparatively more strongly developed than in *Lophogaster*, consisting, as in that genus, of two distinctly defined joints, the first of which is short and broad, the last oblong-ovate, and densely fringed with bristles arranged along the inner edge in several rows. The exognath forms a rather large ovate or elliptic lamella, attached exteriorly to the distal segment of the basal part, and fringed with a dense row of very strong and elongate ciliated bristles, all of which exhibit a distinct articulation near the base. This lamella, too, as stated above, fits comparatively closely into the lateral emargination of the carapace at the side of the buccal area (see Pl. IV. fig. 4), forming, as it were, a kind of piston, by the oscillatory movements of which the postero-anterior current of water produced beneath the free portion of the carapace may be regulated.

The maxillipeds (see Pl. IV. fig. 4; Pl. VIII. fig. 8) are rather short and thickset in form, always closely applied to the other oral parts, which are partially covered by them inferiorly. The basal part forms a rather strong transverse trunk, indistinctly divided into two segments, and giving origin, at its anterior extremity, to the incurved terminal part or palp, whereas, exteriorly, there is appended to the base a freely movable membranous plate (*ep*) projecting within the branchial cavity, representing the epipodite. This epipodite, as in *Lophogaster*, is of very considerable size, almost equalling in length the whole maxilliped, and exhibits a narrow lanceolate form, the apex being somewhat recurved. Its function, too, is more properly to produce by its rhythmical movements to and fro, the current of water flowing beneath the free portion of the carapace, and bathing the gill-branches attached outside the bases of the legs. The exopodite is present only in four of the species, viz., *Gnathophausia ingens*, *Gnathophausia gigas*, *Gnathophausia calcarata*, and *Gnathophausia gracilis*, as a very small narrow linguiform plate, fringed with ciliated bristles (see Pl. IV. fig. 4). In the remaining species it is, on the other hand, wholly wanting, and in its place may be observed a small depression invested with a thickened glabrous cuticle (Pl. VIII. fig. 8, *x*), into which the above-mentioned mamillar prominence of the second pair of maxillæ would appear to fit (see Pl. VIII. fig. 17). The terminal part, or palp, scarcely exceeds in length the basal, and is densely beset with bristles on both margins. It consists of five distinctly defined joints, the third of which (carpus) is rather large and laminarly expanded. The terminal joint (dactylus) is lanceolate, and at the inner edge finely dentate. Of distinctly developed masticatory lobes no trace can be found.

The first pair of legs (Pl. VIII. fig. 9) differ but very slightly in appearance from the remaining ones, and cannot therefore be strictly regarded as true gnathopoda. The basal section, contrary to what is the case in the maxillipeds, is exceedingly short, whereas the

terminal part forms a very elongate five-jointed stem. Of the joints the carpal, as in the maxillipeds, is by far the largest, being even longer than the whole of the preceding part of the leg. It is greatly compressed and somewhat expanded toward the end, being fringed moreover at the distal part of the exterior edge with a row of very long, anteriorly curving, ciliated bristles. The inner edge of this joint, too, is likewise provided with several slender bristles, as also with a dense series of delicate curved spinules, crowded together at the distal part. The succeeding joint (propodus), which, as a rule, along with the carpal joint forms a strong geniculate curve, is likewise rather elongate, but considerably narrower, somewhat curved, and densely setigerous, more especially at the inner edge. The terminal joint or dactylus is narrow, lanceolate, and armed at the inner edge with a dense row of small spinules, as also with a few elongated bristles. The exopod, as in the succeeding legs, is developed into a powerful natatory branch, on which can be distinguished a somewhat thickened and strongly muscular basal part, together with a narrow and very flexible multiarticulate terminal part, furnished on both edges with strong natatory setæ. At the base of this leg is attached a fully developed gill of precisely the same structure as that characterising the five succeeding pairs of legs. Projecting from the outer side of the basal part, may also be observed a very small linguiform lobe, fringed with several exceedingly long and slender diverging bristles. This lobe, which also occurs on the remaining legs (see fig. 10, *ep*), would seem to represent a kind of rudimentary epipod.

The succeeding legs (see Pl. VIII. figs. 10, 16) are all comparatively uniform in structure, and very similar in appearance to the first pair, described above, differing only in the carpal joint being somewhat less expanded and without the long ciliated bristles at the outer edge, and also in the propodal joint being straighter and having the bristles arranged in more or less distinct fascicles. This arrangement of the bristles induced the late Dr. v. Willemoes-Suhm to describe the terminal portion of the legs as subdivided into short articulations, as in the Mysidæ, a character which, however, has not been proved in reality to exist.

The legs, having all the character of true pereiopoda, as a rule diminish somewhat in size posteriorly, likewise assuming, successively, a more slender form (see fig. 16). On the last pair (fig. 14) the carpal and propodal joints become very narrow and of nearly uniform length, both being furnished with numerous distinctly defined fascicles of bristles. The terminal claw moreover is rather small and of a conical form.

The gills (see Pl. VIII. figs. 16, 17) exhibit a rather complex structure, and occur at the bases of all the legs. At the last pair, however (see fig. 14, *br*), they are very small and rudimentary, merely consisting of a single branch placed at the outer side. On the other hand, all the remaining gills (six pairs in number) are of a perfectly uniform structure, consisting of no less than four principal branches (see figs. 9, 11) springing from a common base. Of these branches the largest, as in *Lophogaster*, is

bent towards the ventral face, where it is freely suspended, meeting the corresponding branch on the opposite side in the median line (see fig. 16), whereas the remaining three branches occur on the exterior side of the legs and are completely covered by the marginal portion of the carapace. Every gill-branch, too, consists of a median stem, sending off in comparatively regular sequence secondary branches from each side, whereby the whole branch acquires a bipinnate appearance. The secondary branches or pinnulæ are, furthermore, divided into a vast number of small lobes (see fig. 13) arranged with less regularity, and even these lobes may occasionally be found,—especially on the inner part of the gill-branch,—to be subdivided into smaller lobules. The final ramifications of the gills are always of a simple cylindrical, or rather vesicular, form, never, as in *Lophogaster*, foliaceous. Regarding the insertion of the gills, they would seem to originate at the articulation between the bases of the legs and the pleuron of the corresponding segment, and hence may properly be designated "arthrobranchiæ," although, on dissection, they remain as a general rule in connexion with the legs.

In the fully developed females, as with *Lophogaster*, seven pairs of large foliaceous lamellæ, fringed at the edges with bristles, spring from the bases of all the legs, and, folding one over the other in the median line, form a capacious marsupial pouch, projecting from beneath the trunk (see Pl. II. fig. 1; Pl. V. fig. 1; Pl. VI. fig. 6).

In the males, on the other hand, may be observed, at the base of the last pair of legs posteriorly (see Pl. VIII. fig. 14, *p*, and fig. 15) and on each side, a small tuberculiform prominence, representing the outer sexual appendage, and having at its extremity the fissure-like opening for the efferent duct of the testes.

The caudal limbs (Pl. VIII. fig. 18) in both sexes are developed in the same manner as powerful natatory organs, consisting of a somewhat applanated and strongly muscular basal part, and two very elongate and slender terminal branches, the outer part of which is subdivided into a great number of small articulations furnished with strong natatory setæ. They all exhibit a perfectly uniform structure, none of them in the males being distinguished by the slightest peculiarity, as is the case in the Euphausiidæ and Mysidæ.

The telson (see Pl. II. fig. 7; Pl. III. fig. 6; Pl. IV. fig. 7, &c.) is exceedingly large, and has the upper face somewhat channelled along the middle, exhibiting on each side an obtuse longitudinal keel. It is slightly constricted near the base, and tapers more or less rapidly toward the apex, which juts out into two strongly curved spines, connected in the middle by a serrate lamella, thus forming together an almost semilunar projection. The lateral edges of the telson are densely spinulous throughout their distal portion, the spinules being of somewhat unequal size, so that between two larger ones, as a rule, occur a more or less considerable number of much smaller ones. At the base of the telson, on the ventral face, is placed as usual the fissure-like anal opening.

The uropoda (*ibid.*) are generally shorter than the telson, and consist of an exceedingly short basal part and two terminal plates, which admit of being spread out on

either side, so as to form, along with the telson, a complete caudal fan. The outer plate is the larger of the two, and has the outer edge rather arched in the middle, and terminating posteriorly in a short dentiform projection, invariably placed at some distance from the apex. From this projection, too, a distinctly marked transverse suture passes obliquely across the plate, marking off the linguiform terminal portion of the plate as a distinct joint, which, to a certain extent, would even appear to be movable by the help of two thin muscles, proceeding to it from the proximal segment of the plate. The whole of the interior border of this plate, as also the terminal lobe, is fringed with a dense row of ciliated bristles. The inner plate is generally both somewhat shorter and much narrower than the outer, and lanceolate in form, being also fringed around all its borders with a row of similar bristles.

Nervous System.—The ventral chain of ganglia (see Pl. VIII. fig. 19) is more especially distinguished by the very inconsiderable degree of centralisation observed in the portion belonging to the anterior division of the body, exhibiting thereby a striking resemblance to that in some lower forms of Crustacea, for example in Isopoda and Amphipoda. The several ganglia are, on the whole, of a very uniform appearance, and connected by rather long double commissures, their original twofold nature being also distinctly perceptible. Exclusive of the cephalic or supra-œsophageal ganglion, nine ganglia are found to belong to the anterior division of the body, and six to the posterior, making in all fifteen different ganglia. Of these, only the two foremost (1–2), providing the buccal parts with nerves, are partly coalescent, while all the rest are distinctly definable. The commissures connecting the second and third ganglia are certainly very short, leaving between them only a small rounded opening; but the rest are of considerable length and of distinctly fibrous structure. On the upper side of each of the ganglia, counting from the fourth to the eighth, is observed a ligature-like, transverse commissure (see fig. 20), arching over and holding in position the great ventral artery (*a*) which, passing forward, sends off on each side immediately behind the ganglia a lateral branch for the corresponding leg and its several appendages.

The ganglia of the tail (see fig. 19) are somewhat inferior in size to those of the trunk, and are connected by much longer commissures, which, moreover, are placed close together. The last caudal ganglion (6), occurring at the base of the caudal fan, is somewhat larger than those preceding it, and sends off numerous nerves, some entering the telson, some the uropoda, and finally innervates the muscles surrounding the anal opening.

Colour.—As has been stated by the late Dr. v. Willemoes-Suhm, all the specimens examined by him belonging to this genus were, while still alive or in a fresh state, of a vivid red colour, and in reality it is probable that this characteristic is common to all the species, a similar colour being likewise observed in several other deep-sea Crustacea.

Habitat.—All the species belonging to the present genus seem to be well marked deep-sea forms. The least depth from which specimens have been obtained is

255 fathoms (*Gnathophausia longispina*), the greatest 2200 fathoms (*Gnathophausia gigas*). *Gnathophausia* has never been taken at the surface of the sea, although the surface-net was in frequent use during the Expedition, both by night and day, and in many different tracts of the ocean. It may therefore certainly be assumed that these Crustacea, notwithstanding their strongly developed natatory organs, never leave the deeper strata of the sea, and that in all probability they have their habitat on the sea-bottom itself.

To judge from the inconsiderable number of examples of each species obtained by the Expedition, notwithstanding that a large trawl-net was generally in use, it would appear that the animals of this genus lead a comparatively isolated existence, being seldom met with in shoals.

Distribution.—The genus seems to exhibit a very extensive geographical distribution, being most probably represented throughout the greater part of the ocean, excepting perhaps the Arctic and Antarctic regions. Thus, as will be shown in the sequel, species of this genus have been recorded both from the North and South Atlantic, from the Pacific, and from the seas of the Indian Archipelago. The genus may even be reckoned among the European fauna, one of its species (*Gnathophausia zoëa*) having been found by the French expedition in the Bay of Biscay.

Classification.—The species may be naturally classed within two or rather three sections or subgenera, chiefly characterised by the form of the antennal scale, the presence or absence of an exopodite on the maxillipeds, and finally by the form of the carapace.

The following synopsis of the species may be here appended :—

Synopsis of the Species of Gnathophausia.

- Antennal scale
  - very small, not jointed, outer margin serrate. Rostrum
    - short, indistinctly denticulate, ... *G. ingens*, Dohrn.
    - elongate. Infero-posterior corners of carapace
      - slightly produced, . *G. gigas*, Suhm.
      - produced as long serrate spines, . . *G. calcarata*, G. O. Sars.
  - large, of usual form, jointed, outer margin terminating in a strong spine. Inferoposterior corners of carapace
    - rounded off. Dorsal spine
      - comparatively short. Upper lateral keel
        - distinct. Epimera of the caudal segments
          - sharply pointed, *G. willemoesii*, G. O. Sars.
          - obtuse, . *G. affinis*, G. O. Sars.
        - obsolete, . . . *G. elegans*, G. O. Sars.
      - greatly produced. Antennal scale with spine of the outer corner
        - of moderate size, . *G. zoëa*, Suhm.
        - greatly produced and serrate on both margins, . . *G. longispina*, G. O. Sars.
    - produced into two distinct spines, . . . *G. gracilis*, Suhm.

Section 1.—Infero-posterior corners of carapace produced into sharp points more or less elongated. Dorsal spine short or obsolete. Dorsal keel of carapace interrupted in the middle part. Supra-orbital spines small or obsolete. Antennal scale small, not jointed, outer margin serrate. Maxillipeds with a small exopodite. Epimeral spines of the last caudal segment confluent on the ventral face, forming together a cordiform concave plate, incised at the apex.

3. *Gnathophausia ingens* (Dohrn) (Pl. II.).

Lophogaster ingens, Dohrn, Untersuchungen über Bau und Entwickelung der Arthropoden, Zeitschr. f. wiss. Zool., Bd. xx. p. 610, pl. xxxi. figs. 12–14, 1870.
Gnathophausia inflata, Suhm, MS.
Gnathophausia ingens, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 3.

Specific Characters.—Form of body rather robust, the anterior division (in the female) greatly inflated. Carapace large, with the infero-posterior corners produced into small slightly curved spines. Dorsal spine very short, almost obsolete. Rostrum short, very broad at the base, indistinctly denticulate. Supra-orbital spines wanting; antennal spines small but distinct; branchiostegal spines obsolete. Eyes with rather long and narrow pedicles, cornea somewhat expanded. Antennal scale very small, subovate, apex truncate, outer edge minutely serrate in the distal half. Caudal segments distinctly sculptured, both lappets of the epimera pointed. Epimeral plate of last segment large and deeply cleft at apex. Telson much longer than uropods; its lateral edges evenly arched. Length, 157 mm.

Remarks.—The present gigantic Schizopod had already been described and figured by Professor A. Dohrn in the year 1870 from a somewhat defective specimen sent him from the Zoological Museum of Hamburg. Notwithstanding that all the legs in his specimen had been broken, Professor Dohrn was yet able to recognise it as a true Schizopod, most nearly approximating to *Lophogaster;* and he described it as a new species of the genus under the name of *Lophogaster ingens.* The examination of the specimen procured by the Challenger Expedition, which is comparatively well preserved, fully confirms this view, so far as regards the Schizopod nature of this form and its relationship to *Lophogaster.* On the other hand, it cannot at present be strictly referred to the last mentioned genus, but is to be regarded as a true *Gnathophausia.* This view was also suggested by the late Dr. v. Willemoes-Suhm, who, in his manuscript notes, has mentioned this form under the name of *Gnathophausia inflata*, n. sp. The specific denomination "*ingens*" proposed by Dohrn having, however, been given prior to the Challenger Expedition, must of course be retained for the species.

Description.—The specimen obtained by the Challenger Expedition is a full-grown

female, with enormously developed marsupial pouch, from which apparently the young had just emerged.

The length of the body, measured from the tip of the rostrum to the extremity of the telson, is 157 mm., a truly gigantic size for a Schizopod; and this form ranks therefore as the largest by far of all hitherto known Schizopods. The specimen examined by Professor Dohrn was likewise very large, measuring 155 mm. in length.

The general form of the body (see figs. 1 and 2) is comparatively rather clumsy and thickset, the anterior division being very massive and greatly inflated, and fully attaining the length of the tail.

The integuments are throughout rather soft and flexible, exhibiting, as it were, a parchment-like consistence.

The carapace is of very considerable size, completely covering the whole of the anterior division of the body, and even somewhat overlapping at the sides the first caudal segment. It is, too, evenly arched above and rather broader than high. The two lateral keels are somewhat prominent; on the other hand, the dorsal carina is wholly effaced in the middle of the carapace, being distinct on the rostral part only, and far behind, where it terminates in a very short pointed projection, or a rudiment of the dorsal spine. Between the anterior part of the two upper lateral keels is seen the linguiform dorsal area (see fig. 2), which only reaches to about the middle of the length of the carapace. The rostrum is comparatively short, but very broad and massive at the base, and forms a horizontal, triangular projection, protruding from the anterior part of the carapace, and partly covering the antennular peduncles and the inner part of the ocular pedicles. It terminates in a sharp point, and exhibits but very faint traces of the usual denticles, which in other species are to be found both on the dorsal and the lateral keels. Of supra-orbital spines, no trace whatever can be detected. On the other hand, the antero-lateral corners of the carapace jut out as distinct, though rather small, antennal spines; and slightly posterior to each spine may be observed a small projection, representing a rudiment of the branchiostegal spine. Posteriorly, the carapace forms in the middle a rather deep emargination, embracing here, as it were, the first caudal segment. The infero-posterior corners (see fig. 1) are produced as very short spines, curving somewhat upward, and the posterior margin of the carapace forms on either side immediately above this spine an evenly arched curve. Moreover, at some distance from the edge may be observed two parallel elevated lines, connecting the two lateral keels, and these are also continued above to the dorsal carina.

The tail, as in the other species of the genus, is very slender and almost cylindrical in form, though somewhat flattened above. It exhibits a very conspicuous sculpture, consisting of numerous irregularly flexuous impressions, limited by elevated lines, giving to that part a peculiarly wrinkled appearance. Its segments are nearly of uniform length, but diminish somewhat both in height and breadth posteriorly. The epimera

are distinctly developed and almost perpendicular, projecting into two acutely pointed lappets, of which the posterior is the larger and is provided with an elevated keel.

The last segment, as in the other species, is divided by an obliquely transverse suture into two sections, the anterior of which juts out on either side into an epimeral projection, which unites on the ventral face with the corresponding one on the opposite side, forming together a large cordiform plate, concave in the middle and cleft at the apex into two slender, bidentate lappets, reaching even somewhat beyond the extremity of the segment (see fig. 6).

The eyes (fig. 3) are more especially distinguished by the considerable length of the pedicles, which are very narrow, and apparently consist of two segments, the external one exhibiting above a small papillary projection. The cornea is rather expanded and somewhat oblique, occupying, however, but a comparatively small part of the eye itself.

The antennular peduncle (see figs. 1 and 2) is very short and thick, scarcely reaching beyond the eyes when they are extended. The flagella, too, were partly defective in the specimen examined.

The antennal scale (see fig. 4) is comparatively very small and of an oval form, the extremity being truncated or very slightly emarginate, with the inner corner a little more prominent than the outer. The outer edge is somewhat arched, and, in its distal half, armed with about six very small and inconspicuous teeth. The inner edge, too, is almost straight, being rather strongly arched in its hindmost part; it is fringed throughout with a dense row of comparatively short bristles.

The oral parts, so far at least as they admit of being examined without dissection, would seem on the whole to agree perfectly with those in the two succeeding species. As in the latter, the maxillipeds are provided with a distinct though very small lamelliform exopodite.

The legs (fig. 5) are comparatively rather robust in structure and densely setigerous on both margins, the carpal and propodal joints being strongly compressed and the dactylus rather small.

The incubatory lamellæ, composing the marsupial pouch, are, in the specimen treated of here, exceedingly large, of an oblong-ovate form, and densely setose at the edges, forming together a very conspicuous, convex prominence beneath the trunk (see fig. 1).

The telson (see fig. 7) is very large and massive, equalling in length the three preceding segments taken together. The outer part tapers successively toward the apex, and has the lateral edges but slightly arched and armed with a vast number of fine spinules. The two falciform apical spines are, as usual, confluent at the base, forming together a semilunar projection appended to the apex of the telson, with its posterior concave margin finely serrate.

The uropoda (*ibid.*) are much shorter than the telson, but otherwise exhibit the structure characteristic of the genus.

Habitat.—The above described specimen was obtained by the Challenger Expedition, in the vicinity of the Arrou Islands, in the Arafura Sea, lying between New Guinea and Australia.

Station 191, September 23, 1874; lat. 5° 41′ S., long. 134° 4′ 30″ E.; depth, 800 fathoms; green mud; bottom temperature, 39°·5.

The specimen examined by Professor Dohrn, according to the label on the bottle containing it, was procured off the coast of Africa ("Laos"); depth not recorded.

4. *Gnathophausia gigas*, Willemoes-Suhm (Pl. III.).

Gnathophausia gigas, Suhm, Trans. Linn. Soc. Lond. (Zool.), ser. 2, vol. i. p. 28, pl. ix. figs. 16, 17; pl. x. figs. 2, 3, 1875.

Gnathophausia gigas, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 4.

Specific Characters.—Form of body (in male) rather more slender than in the last species. Carapace less tumid, having the infero-posterior corners more produced and jutting out into short mucroniform spines, reaching to the end of the second caudal segment. Dorsal spine almost obsolete. Rostrum rather produced and slender, distinctly denticulate. Supra-orbital, antennal, and branchiostegal spines all distinct but small. Caudal segments less distinctly sculptured, the anterior lappet of the epimera small and rounded. Epimeral plate of last segment less produced. Eyes narrow, with cornea very small. Antennal scale much larger than in *Gnathophausia ingens*, and somewhat tapering toward the apex, outer edge divided into four strong teeth, inner corner produced into a rather prominent sharp point. Telson very large, with the lateral margins bulging out in the middle and densely spinulose, terminal spines widely diverging. Length, 142 mm.

Remarks.—The present species has already been briefly described and figured by the late Dr. v. Willemoes-Suhm in the above quoted treatise, and designated by the specific name of "*gigas*," the preceding still larger form not being known to him at that date. From this latter species it differs, among other characteristics, by the comparatively more slender form of the body, the much more produced rostrum, the larger and differently formed antennal scale, and the less completely developed eyes. Moreover, the spines, issuing from the infero-posterior corners of the carapace, are somewhat different in shape, and the sculpturing of the tail is by no means equally conspicuous.

Description.—Of this species, also, only a solitary specimen in an excellent state of preservation was obtained, viz., a full-grown male, measuring in length 142 mm. As the males of this genus differ but very slightly from the females, it may not unreasonably be inferred that the characters adduced above as specific marks would, on the whole, be no less applicable to the females of this species.

The form of the body (see figs. 1, 2) is rather more slender than in *Gnathophausia ingens*, but in this respect, probably some regard should be paid to the circumstance

that the specimen under treatment is a male, while that representing the preceding species is a female.

The integuments are throughout very thin, and in the spirit specimen semi-diaphaneous, so as to admit of the muscular system being distinctly traceable through the skin.

Here, too, the carapace covers the whole of the anterior division of the body, but is far from being so inflated as in *Gnathophausia ingens*, its breadth scarcely exceeding its height. The lateral wings are comparatively more produced, and terminate in a perfectly straight, mucroniform spine, reaching as far as the end of the second caudal segment. The keels of the carapace, as also the dorsal area, exhibit precisely the same appearance as in the preceding species. On the other hand, the rostrum would seem to have been much more produced, though I cannot myself state its length with exactness, the point having been broken off in the specimen. To judge, however, from the form of its basal part still remaining, it may certainly be inferred to have been at least much more elongate than in *Gnathophausia ingens*, and in the figures given by the late Dr. v. Willemoes-Suhm, which were drawn from the recently taken and uninjured specimen, it is in reality represented as being more than half as long as the carapace, and also distinctly denticulate throughout.[1] There is, contrary to what is the case in the preceding species, a distinct, though rather small, supra-orbital spine on either side of the base of the rostrum. Moreover, both the antennal and the branchiostegal spines are distinctly marked.

The caudal segments do not exhibit the peculiar wrinkled sculpture distinguishing this part in *Gnathophausia ingens*, only a slight transverse impression being observable at each extremity. On the epimera, too, the anterior lappet is very short, and rounded at the apex, not pointed as in that species. Here, also, the epimeral projections of the last segment are confluent on the ventral face, forming together a cordiform concave plate (see fig. 5), but this is much shorter than in *Gnathophausia ingens*, and its apical indentation broader.

The eyes (fig. 3), as in *Gnathophausia ingens*, are very narrow, but the cornea is much smaller and scarcely expanded at all; moreover, the ocular papilla is situated closer to the base of the pedicle.

The antennular peduncle (see figs. 1, 2) is greatly thickened, with the second joint exceedingly short, and almost discoid. The outer flagellum is indeed enormously developed, even exceeding in length the whole body, being also very strong and distinctly riband-shaped. The inner flagellum is much more slender, and about the same length as the carapace, exclusive of the rostrum.

The antennal scale (fig. 4) considerably exceeds in size that of the preceding species, and also exhibits a rather different form, tapering somewhat toward the apex, the inner

[1] In Pl. III. figs. 1 and 2 given in the present Report, the missing part of the rostrum has been added after the drawings of Dr. v. Willemoes-Suhm.

corner of which is drawn out to a very prominent and sharply pointed projection. The outer edge is, moreover, divided into four strong teeth, somewhat increasing in size toward the apex; and between the last of these and the inner corner, the edge of the scale is evenly emarginate. The flagellum about equals in length the inner antennular flagellum.

The oral appendages and the legs do not seem to exhibit any essential difference from the same limbs in *Gnathophausia ingens*.

On the other hand, the caudal limbs appear to be somewhat more strongly developed, but this may arise from the circumstance that the specimen treated of is a full-grown male.

The telson (see fig. 6) is of very considerable size, even surpassing in length the three preceding segments taken together. In form it agrees very closely with that of the preceding species, differing only in the lateral edges being somewhat more abruptly arcuate in the middle, and in the marginal spinules being comparatively coarser. The apical spines (see fig. 7) are widely divergent, and are furnished near the point on the outer side with a small tooth; the evenly concave margin connecting both spines is finely and regularly serrate.

The uropoda (*ibid.*) seem to be a little more elongate than in *Gnathophausia ingens*, but in other respects exhibit a very similar appearance.

Habitat.—The specimen described above was taken in the North Atlantic, west of the Azores, at a very considerable depth.

Station 69, June 25, 1873; lat. 38° 23′ N., long. 37° 21′ W.; depth, 2200 fathoms; Globigerina ooze; bottom temperature, 36°·2.

Exclusive of this specimen, I also found among the material placed in my hands for examination the recently moulted skin of the outer part of the tail of another specimen, apparently belonging to the same species. This skin was brought up along with specimens of *Boreomysis scyphops*, in the Southern Ocean, between Kerguelen and Australia.

Station 157, March 3, 1874; lat. 53° 55′ S., long. 108° 35′ E.; depth, 1950 fathoms; Diatom ooze; bottom temperature, 32°·1.

Hence the species seems to exhibit a rather extensive geographical distribution, its occurrence in both hemispheres having been ascertained.

5. *Gnathophausia calcarata*, G. O. Sars (Pl. IV.).

Gnathophausia gigas, var., Suhm MS.
Gnathophausia calcarata, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 5.

Specific Characters.—Integuments rather firm. Carapace with a well marked, although somewhat short, dorsal spine, projecting from the middle of the posterior margin, the infero-posterior corners produced into very long and slender, finely serrate

spines. Rostrum strong, of about the same length as the carapace, distinctly denticulate. Supra-orbital spines obsolete, antennal and branchiostegal spines well defined, the latter remarkably strong and finely serrate, pointing outward. Caudal segments sculptured with transverse impressions, epimera produced into two acuminate lappets of nearly equal size. Eyes pyriform, cornea rather expanded. Antennal scale very small, ovate, outer margin slightly serrate, apex obliquely truncate, inner margin arcuate. Telson large, with the terminal spines crescent-shaped and denticulate along the upper face. Uropoda much shorter than telson. Length of largest specimen (which had probably reached its maximum size) 98 mm.

Remarks.—This form has been preliminarily recorded by the late Dr. v. Willemoes-Suhm, in his manuscript notes, as a variety of *Gnathophausia gigas*. It should, however, be certainly regarded as a distinct species, though closely related to the two preceding ones. From *Gnathophausia gigas* it may, among other characteristics, be readily distinguished by the unusually firm integuments, the distinctly marked dorsal spine, and the remarkably long spines issuing from the infero-posterior corners of the carapace, a character which has given rise to the specific denomination "*calcarata.*" Futhermore, the rostrum is much coarser in structure, and the branchiostegal spines considerably more developed; while, as a final distinction, the eyes and the antennal scale are of a somewhat different form.

Description.—Of this handsome species there are two well preserved specimens in the collection, both males. The largest specimen has a length of 98 mm.; the other is rather smaller in size, the length being only 68 mm. These two specimens exhibit, it would seem, some difference as regards the length of the rostrum and the lateral spines of the carapace, but in all other respects agree perfectly with each other.

The general form of the body (see figs. 1, 2) closely approximates to that of *Gnathophausia gigas*, though perhaps a trifle more robust.

The integuments are throughout very much firmer than in either of the two preceding species, and apparently they are somewhat indurated, giving to all the parts of the body a more solid and distinctly defined appearance.

The carapace, although rather large, does not cover the trunk to the same extent as in the two preceding species, the last segment being partly exposed behind the posterior margin. Both the lateral keels are strongly prominent, whereas the dorsal keel, as in the former species, is distinct in the anterior and posterior parts only, being quite obsolete in the middle of the carapace. The dorsal spine, projecting from the middle of the posterior margin, is well marked, though not attaining any considerable length. On the other hand, the spines projecting from the infero-posterior corners of the carapace are remarkably elongate and slender, mucroniform, and somewhat diverging, being finely serrate at the edges. In the smaller specimen (see fig. 3) these spines are much produced, reaching even to the end of the third caudal segment; in the larger one (figs. 1, 2) they

are somewhat shorter, but, in other respects, of very similar appearance. As in *Gnathophausia ingens*, two distinctly elevated lines may be observed a short distance within the posterior margin of the carapace, running parallel to the edge. The rostrum is strongly developed, and rather produced, in the smaller specimen (fig. 3) being about as long as the carapace, in the larger (figs. 1, 2) somewhat shorter. It extends, as usual, horizontally, and is three-edged and distinctly denticulate throughout, terminating in a sharp point. The supra-orbital spines would seem to be wanting, or at least are very inconspicuous, the slight projections seen at the base of the rostrum (fig. 3, *a*) being simply a pair of the lateral rostral denticles placed at some distance posterior to the others. On the other hand, the antennal spines (*b*) are very distinctly marked, and the branchiostegal spines (*c*) distinguished by very considerable size, jutting out on either side as a pair of strong, denticulated processes.

All the caudal segments exhibit, at some distance from the posterior margin, a rather deep transverse impression, and, in addition to this characteristic, are very sharply defined, the one from the other. As in *Gnathophausia ingens*, both lappets of the epimera are acutely pointed and somewhat produced, the anterior being a trifle smaller than the posterior. The epimeral spines of the last segment (see fig. 6) in this species are also partly connected on the ventral face, and are rather smaller than in the two preceding species, the terminal indentation between their outer parts being also shorter and broader.

The eyes (see figs. 1, 2, 4) are slightly dilated toward the apex, almost clavate in form, the cornea being more expanded than in the preceding species.

The outer flagellum of the antennulæ (see figs. 1, 2) is remarkably strong, and about equal in length to the whole body, the rostrum excepted.

The antennal scale (see figs. 4, *a*, 5) is comparatively very small, and ovate in form, somewhat resembling that of *Gnathophausia ingens*. Its apex, however, is here obliquely truncate, not emarginate, and the inner corner is rather more prominent than in that species. The outer edge exhibits in its distal part five or six somewhat unequal and rather small teeth, and the inner setigerous edge is more evenly curved than in *Gnathophausia ingens*.

The oral parts (see fig. 4), the legs, and the caudal limbs would seem on the whole to agree perfectly with the same parts in the two preceding species, save, perhaps, that the legs are somewhat more robust in form and less elongate.

The telson (see fig. 7), as in the two preceding species, is very large and massive, about equalling in length the three preceding segments taken together, and it gradually tapers toward the apex, the lateral edges being evenly arched, and armed with a large number of small spinules. The two apical spines, connected as usual in the middle, form a comparatively regular crescent-shaped projection, finely serrate at the bottom of the posterior emargination, and, moreover, exhibiting on the upper face a row of small denticles.

The uropoda (*ibid.*) are much shorter than the telson, and have a somewhat similar form to those in *Gnathophausia ingens*.

Habitat.—Of the two specimens obtained by the Challenger Expedition, the larger was taken, along with the above described specimen of *Gnathophausia ingens*, in the Arafura Sea.

Station 191, September 23, 1874; lat. 5° 41′ S., long. 134° 4′ 30″ E.; depth, 800 fathoms; green mud; bottom temperature, 39°·5.

The other specimen was obtained in the vicinity of the Talaur Islands, south of Mindanao (Philippines).

Station 214, February 10, 1875; lat. 4° 33′ N., long. 127° 6′ E.; depth, 500 fathoms; blue mud; bottom temperature, 41°·8.

Hence the geographical distribution of this species, so far as is at present known, ranges within the seas of the East Indian Archipelago.

Section 2.—Infero-posterior corners of carapace rounded off. Dorsal spine produced. Dorsal keel uninterrupted in the middle. Supra-orbital spines distinctly defined from the rostral part of carapace, and rather large. Antennal scale of the form usually met with in the Caridea, jointed at the extremity, outer edge jutting out anteriorly as a more or less produced spine. Maxillipeds without any trace of exopodites. Epimeral spines of last caudal segment not confluent on the ventral face.

6. *Gnathophausia willemoesii*, G. O. Sars (Pl. V. figs. 1–6).

Gnathophausia zoëa, var., Suhm MS.
Gnathophausia willemoesii, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 6.

Specific Characters.—Form of body rather robust. Carapace covering whole of trunk, with the dorsal spine comparatively short, projecting only a little beyond the first caudal segment. Rostrum shorter than carapace, very narrow, and provided with small denticles comparatively few in number. Supra-orbital spines very strong, anteriorly curved; antennal spines distinct; branchiostegal spines obsolete. Five anterior caudal segments keeled above, and produced posteriorly into short but distinct dorsal processes; posterior lappet of epimera lanceolate. Eyes pyriform. Antennal scale rather large, only twice as long as broad, terminal lobe but slightly projecting beyond the spine of the outer corner. Telson linguiform, lateral margins evenly curved and densely spinulous; apical spines rather short, serrate at the posterior margin. Uropoda somewhat shorter than telson. Length 136 mm.

Remarks.—In his manuscript notes the late Dr. v. Willemoes-Suhm has recorded,

with a certain amount of hesitation, this form as a variety of *Gnathophausia zoëa*. In my opinion, however, it should decidedly be regarded as a distinct species, although belonging to the same section of the genus as that species. From *Gnathophausia zoëa* (see Pl. VI. figs. 6, 7) it may at a glance be distinguished by the far inferior development of both the dorsal spine and the rostrum, by the different form of the antennal scale, and finally by its much greater size.

Description.—There are two specimens of this species in the collection; one of very considerable size, reaching a length of 136 mm. This is a female, with distinctly developed incubatory lamellæ. The other specimen is somewhat smaller, and would seem to be a male, as no trace of incubatory lamellæ can be discerned, but in other respects it agrees perfectly with the first named specimen.

The form of the body (see figs. 1, 2), as compared with that of the other species belonging to this section, is rather robust, the anterior division being unusually massive and thickset.

The integuments are not very firm, though somewhat more so than in *Gnathophausia ingens* and *Gnathophausia gigas*.

The carapace is rather large, covering the whole of the trunk, none of the segments of the latter being exposed. It is evenly arched above, and about as broad as high. Both the lateral keels are distinctly marked, though by no means so prominent as in *Gnathophausia calcarata*. The dorsal keel in this species does not experience any interruption whatever, being continued along the whole back of the carapace, and running out posteriorly as a strong mucroniform projection—the dorsal spine. This spine, too, is decidedly glabrous, and does not attain any considerable length, projecting but slightly beyond the first caudal segment. As in the other species belonging to this section, the infero-posterior corners of the carapace are evenly rounded off, without any trace of the spine occurring here in the three preceding species. Moreover, the lower lateral keel, which in these species runs out into the said spine, in this animal curves upward before reaching the margin, and joins the upper one at the base of the dorsal spine. Close to the posterior margin another elevated line may be seen, which, in connexion with the above mentioned continuation of the lateral keel, marks off a slight groove, running parallel to the posterior edge of the carapace. The rostrum is exceedingly slender, and does not seem to attain the length of the carapace. The point in both specimens, however, having been broken off, its length cannot be stated with perfect accuracy. It is very slightly curved, and exhibits in its distal part a few small denticles, arranged dorsally as well as laterally, the proximal part being wholly unarmed. The supra-orbital spines are distinctly marked off from the rostrum, jutting out as two very strong, anteriorly curving, and acutely pointed, projections, to either side from the frontal part of the carapace, partly covering the bases of the eyes above. The antennal spines, too, are rather well defined and somewhat diverging. On the other hand, the branchiostegal spines are quite absent,

their place being occupied by the rounded lateral expansions of the carapace to the sides of the buccal area.

Of the caudal segments, the five anterior ones are distinctly keeled along the middle of the dorsal face, and jut out at the posterior margin into short posteriorly pointing spines. The epimera are rather small, and the anterior lappet is almost obsolete, whereas the posterior is somewhat produced and acutely pointed. The epimeral spines on the last segment are comparatively small, and do not, as in the preceding species, unite on the ventral face, being on the contrary, separated by a distinct interstice (see fig. 5).

The eyes (fig. 3) are rather short and pyriform, the cornea being greatly expanded, and occupying a considerable part of the eye. The ocular papilla is very small, and placed about the middle of the pedicle.

The antennulæ (see figs. 1, 2) exhibit the usual structure, the peduncle being short and thick, and the outer flagellum strongly developed, almost equalling in length the whole body.

The antennal scale (fig. 4), on the other hand, does not show any resemblance to that in the three preceding species, being more in accordance with the structure usually met with in the Caridea. It is rather large and oblong-ovate in form, about twice as long as broad, with the inner edge very considerably arched in its proximal part, the outer almost straight, and running out into a strong, anteriorly pointing, spine. The terminal part of the scale forms a linguiform lobe, projecting a little beyond the said spine, and fringed throughout with a dense row of ciliated bristles, which is also continued along the whole internal margin of the scale. From the base of the above mentioned spine, a distinctly marked suture passes, in an obliquely transverse direction, across the scale, dividing it into two segments, which to a certain extent will admit of being moved towards each other, a fascicle of short muscles joining the suture posteriorly.

The oral parts do not seem to exhibit any essential difference from those in the preceding species, except that, as in all the species belonging to this section, the maxillipeds are found wholly destitute of the exopodites.

Moreover, the legs and caudal limbs are of a very similar structure.

The telson (fig. 6) is rather large, though perhaps less massive than in the three preceding species, and exhibits a comparatively regular linguiform shape, the lateral margins being evenly arched in their distal part, and armed with numerous delicate spinules arranged in the usual manner. The apical spines are rather small, forming together, as in the other species, a crescent-like projection, finely serrate along the evenly concave posterior margin.

The uropoda (see figs. 1, 2), as in the other species belonging to this section, are rather larger than in the three preceding ones, reaching almost to the tip of the telson, when extended posteriorly; their structure, however, is very similar to that in the above mentioned species.

Habitat.—The two specimens of this species procured by the Challenger Expedition were taken in the same locality, south of Amboina, in the Banda Sea.

Station 195, October 3, 1874; lat. 4° 21′ S., long. 129° 7′ E.; depth, 1425 fathoms; blue mud; bottom temperature, 38°·0.

7. *Gnathophausia affinis*, G. O. Sars (Pl. V. figs. 7–10).

Gnathophausia affinis, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 7.

Specific Characters.—Form of body more slender than in the last species. Carapace comparatively small, not covering completely the last segment of the trunk. Dorsal spine rather short, not projecting beyond the first caudal segment. Rostrum shorter than carapace, exhibiting a very close and delicate armature of small denticles, continued above to its very base. Supra-orbital spines not very strong, and somewhat diverging; antennal and branchiostegal spines inconspicuous. Caudal segments not keeled above, nor provided with dorsal processes; posterior lappet of epimera rounded at the tip. Antennal scale narrower than in *Gnathophausia willemoesii*, its terminal lobe greatly surpassing the spine of the outer corner. Telson and uropoda nearly the same as in *Gnathophausia willemoesii*. Length, 81 mm.

Remarks.—This species is very closely allied to *Gnathophausia willemoesii*, but apparently distinct, differing, among other characteristics, in the form and armature of the rostrum, the much smaller supra-orbital spines, and the absence of distinctly defined antennal spines; the caudal segments, moreover, are not keeled above, as in that species, and they have the posterior lappet of the epimera rounded at the tip.

Description.—The solitary specimen procured, and erroneously referred by the late Dr. v. Willemoes-Suhm to *Gnathophausia zoëa*, is a female, with distinct though rather small incubatory lamellæ. It measures 81 mm. in length.

The form of the body (see figs. 7, 8) is somewhat more slender than that of *Gnathophausia willemoesii*, the anterior division being far less tumid than in that species.

The carapace does not completely cover the trunk, the last segment of which appears in part exposed behind its posterior margin. Both lateral keels are distinctly marked, but the lower one disappears at a short distance within the infero-posterior corners of the carapace, without, as in *Gnathophausia willemoesii*, being continued upwards. The dorsal keel, too, is, as in that species, distinctly marked along the whole back of the carapace, though a small impression may be seen above, at a short distance behind the rostrum. The dorsal spine is rather short, not reaching beyond the first caudal segment. The rostrum does not attain the length of the carapace, but is somewhat coarser in structure than that of *Gnathophausia willemoesii*. It is closely armed with a very considerable number of exceedingly small denticles, continued along

the dorsal crest, and even a short distance back on its base. The supra-orbital spines are rather smaller than in *Gnathophausia willemoesii*, and more divergent, scarcely projecting beyond the eyes. No distinct antennal nor branchiostegal spines are present, the lateral expansions of the carapace forming in lieu thereof only two slight angular projections.

The caudal segments do not exhibit any trace of a dorsal keel, nor does their posterior margin form any dorsal projections. The epimera are very small, scarcely projecting even beyond the ventral face, and their posterior lappet is obtusely rounded at the tip.

The eyes are nearly of the same form as in *Gnathophausia willemoesii*.

The antennal scale (see fig. 9) is rather large, but comparatively not so broad as in the preceding species; its terminal lobe, too, is more produced, and projects very considerably beyond the spine of the outer corner.

As regards the oral appendages, the legs, and the caudal limbs, I need not dwell on the description of these parts, as they are much the same in all species belonging to this section.

Moreover, the telson and uropoda (see fig. 10) do not exhibit any essential difference from the same parts in *Gnathophausia willemoesii*, excepting, perhaps, that the lateral margins of the telson are somewhat more strongly arched in the distal part, and that the apical spines have a short denticle at the outer edge.

Habitat.—The specimen described above was taken in the tropical part of the Atlantic, almost midway between Africa and Brazil.

Station 107, August 26, 1873; lat. 1° 22′ N., long. 26° 36′ W.; depth, 1500 fathoms; Globigerina ooze; bottom temperature, 37°·9.

8. *Gnathophausia elegans*, G. O. Sars (Pl. VI. figs. 1–5).

Gnathophausia elegans, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 8.

Specific Characters.—Form of body very slender. Carapace not completely covering the last segment of the trunk, and wanting the upper lateral keel; the cardio-branchial sulcus distinctly marked. Dorsal spine of moderate length, reaching to the end of the second caudal segment. Rostrum rather elongate, equalling the carapace in length, and distinctly denticulate throughout. Supra-orbital spines well marked, though not very strong; antennal spines exceedingly small; branchiostegal spines wanting. Caudal segments rather slender, not keeled above; epimera small, with the posterior lappet but slightly projecting. Antennal scale with the spine of the outer corner smooth, and projecting a trifle beyond the terminal lobe. Telson linguiform, the apical spines very short, and separated by a denticulated cleft. Length, 56 mm.

Remarks.—This is a very fine and elegant species, somewhat resembling *Gnatho-*

phausia zoëa in its general form, but distinguished both from that and all the other species by the absolute want of the upper lateral keel, and by the distinctly impressed cardio-branchial sulcus.

Description.—Of this species, too, a solitary specimen only was obtained, a female, with distinct though not yet fully developed incubatory lamellæ. Length of the specimen only 56 mm.

The form of the body (see figs. 1, 2) is more slender than in any of the other species, excepting perhaps *Gnathophausia gracilis*, Suhm.

As in the preceding species, the carapace does not cover completely the last segment of the trunk, part of which may be seen exposed behind its posterior margin. It juts out posteriorly as a comparatively strong dorsal spine, which, however, does not project beyond the second caudal segment. Of the lateral keels the lower only is distinctly developed, and this curves obliquely upward in its posterior part, terminating at some distance beneath the base of the dorsal spine. The upper lateral keel, on the other hand, distinct in all the other species of the genus, would seem in this one to be wholly wanting. Only when viewed from the dorsal aspect (fig. 2) can two faint lines be discerned, close to the dorsal keel, which, perhaps, may be regarded as corresponding to these keels, but, if so, they have a most anomalous position. The rostrum is rather elongate, attaining the length of the whole carapace, and is coarsely denticulate, the denticles being continued along the upper crest to the base itself, becoming here very small and crowded together. The supra-orbital spines are distinctly developed and somewhat upturned. On the other hand, the antennal spines are exceedingly small; and of the branchiostegal spines no trace whatever can be discerned, the lateral expansions of the carapace behind the antennal spines being evenly rounded, as in *Gnathophausia willemoesii*.

The caudal segments are rather slender, and, as in *Gnathophausia affinis*, without any keel or dorsal projections. The epimera are very small, the posterior lappet scarcely projecting beyond the ventral face. The last segment is conspicuously longer than the preceding, and its two sections very distinctly marked off.

The eyes, as in the two preceding species, are quite short, and clavate in form.

The antennal scale (fig. 3) is more than double the length of the antennular peduncle, and of a form rather similar to that in *Gnathophausia affinis*, with this difference, however, that the terminal lobe is much less produced, the spine of the outer corner projecting considerably beyond it. This spine, too, contrary to what is the case in the following species, is quite smooth.

The telson (fig. 4) exhibits the usual linguiform shape, the lateral margins being rather strongly curved in their distal part, and densely spinulose. The apical spines are somewhat short and thick, armed at the outer edge with a small tooth, and separated in the middle by a distinctly angular cleft, fringed with small denticles (see fig. 5).

Habitat.—The above described specimen was taken in the Pacific Ocean, south of the Fiji Islands.

Station 174c, August 3, 1874; lat. 19° 7′ 50″ S., long. 178° 19′ 35″ E.; depth, 610 fathoms; coral mud; bottom temperature, 39°·0.

9. *Gnathophausia zoëa*, Willemoes-Suhm (Pl. VI. figs. 6–10).

Gnathophausia zoëa, Suhm, Trans. Linn. Soc. Lond. (Zool.), ser. 2, vol. i. p. 32, pl. ix. figs. 2–15, pl. x. fig. 4, 1875.

Gnathophausia zoëa, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 9.

Gnathophausia zoëa, A. Milne-Edwards, Receuil de Figures de Crustacés nouveaux ou peu connus, 1e livraison (two last plates), Paris, April, 1883.

Specific Characters.—The body not so slender as in the two last species. Carapace rather large, completely covering whole of trunk, and produced behind as a very large dorsal spine, in some specimens jutting out even beyond the fourth caudal segment. Posterior margin of carapace in upper part coarsely denticulate, the denticles continued along the lateral edge of the dorsal spine. Both lateral keels distinct. Rostrum very elongate, even exceeding the carapace in length, and strongly denticulate throughout. Supra-orbital and antennal spines well marked and considerably projecting; branchiostegal spines wanting. Caudal segments slightly keeled above, and produced posteriorly into small spines; posterior lappet of epimera acutely pointed. Antennal scale with spine of outer corner somewhat projecting beyond the terminal lobe, and slightly denticulate at the outer edge. Telson of the usual form, the apical spines connected by a thin serrate lamella. Length reaching 70 mm.

Remarks.—This form has been well described and figured by the late Dr. v. Willemoes-Suhm in the above cited treatise, and several figures of the same species have also been prepared by Professor A. Milne-Edwards on two plates, belonging to a collection of drawings of Crustacea, recently published by that author. It may readily be distinguished from the preceding species by the very strong development of the dorsal spine, from which character, indeed, the specific denomination "*zoëa*" has been derived, this name, as is well known, being generally applied to a larval stage of Brachyura, prominently distinguished by the presence of a large dorsal spine issuing from the dorsal surface of the carapace.

Description.—No less than five specimens of this striking form were procured on the Challenger Expedition from different localities. Of these, two are females and three males, all agreeing very closely in all essential characters. The largest of the specimens, a male, attains a length of about 70 mm.

The form of the body (see figs. 6, 7) is somewhat more robust than in the three preceding species, the anterior division being rather more dilated, and the tail not so slender.

The carapace is very large, covering the whole of the trunk, and even somewhat overlapping the anterior part of the first caudal segment. It juts out posteriorly into a remarkably strong dorsal spine of somewhat varying length, but in some specimens projects, when the tail is extended, even beyond its fourth segment. This spine, too, is rather broad at the base, and gradually tapers toward the apex, which is sharply pointed. Both lateral keels of the carapace are distinctly marked, the lower one being placed rather far down, and, as in *Gnathophausia willemoesii*, curving abruptly upward at a short distance from the infero-posterior corners of the carapace, running parallel to the posterior margin, and joining the upper lateral keel at the base of the dorsal spine. The upper part of the posterior margin of the carapace is armed with strong denticles, resembling the teeth of a saw, and these are continued for some distance along the lateral edges of the dorsal spine. The dorsal keel is quite uninterrupted, running along the whole dorsal surface of the carapace, and continued anteriorly on the rostrum, posteriorly on the dorsal spine. The rostrum attains a very considerable size, even exceeding in length the whole carapace, if the dorsal spine be excepted, and is distinctly denticulate throughout. The supra-orbital spines (fig. 8, *a*) are strongly developed, and project far beyond the eyes. The antennal spines (*b*) also attain a comparatively considerable length. On the other hand, the branchiostegal spines are wholly wanting, the lateral expansions of the carapace (*c*) being evenly rounded off, as in *Gnathophausia willemoesii* and *Gnathophausia elegans*.

The five anterior caudal segments are slightly keeled above, and, at the posterior margin, produced as short posteriorly directed spines. The epimera project rather more than in the two species last described, their posterior lappet being acutely pointed.

The eyes, as in the other species belonging to this section, are rather short, and pyriform in shape.

The antennal scale (fig. 9) has much the same form as in *Gnathophausia elegans*, differing only in the spine of the outer corner being slightly serrate along the outer edge.

The telson (see fig. 10) also exhibits a very similar appearance to that in the preceding species, but the apical spines are here connected by a thin but distinct lamella, regularly serrate on its free edge.

The uropoda (*ibid.*) do not quite reach the apex of the telson, and are, in other respects, very similar in structure to those of the other species belonging to this section.

Colour.—According to the statements of Dr. v. Willemoes-Suhm, the Rev. Dr. Norman, Professor A. Milne-Edwards, and the Marquis de Folin, the colour of this form is a magnificent blood-red or carmine.

Habitat.—The specimens procured by the Challenger Expedition were collected at the following localities :—

Station 73, June, 30, 1873; lat. 38° 30′ N., long. 31° 14′ W. (North Atlantic, west of the Azores); depth, 1000 fathoms; Pteropod ooze; bottom temperature, 39°·4.

Station 106, August 25, 1873; lat. 1° 47′ N., long. 24° 26′ W. (Tropical Atlantic); depth, 1850 fathoms; Globigerina ooze; bottom temperature, 36°·6.

Station 126, September 12, 1873; lat. 10° 46′ S., long. 36° 8′ W. (off Rio San Francisco, Brazil); depth, 770 fathoms; red mud.

Station 171, July 15, 1874; lat. 28° 33′ S., long. 177° 50′ W. (Pacific, north of the Kermadec Islands); depth, 600 fathoms; hard ground; bottom temperature, 39°·5.

Distribution.—As may be inferred from the above specified localities, the geographical distribution of the present species is very extensive, ranging from the North Atlantic to the Pacific Ocean. The species also inhabits, as stated above, the seas of Europe, having been found by the French expedition in the Bay of Biscay.

10. *Gnathophausia longispina*, G. O. Sars (Pl. VII. figs. 1–5; Pl. VIII.).

Gnathophausia longispina, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 10.

Specific Characters.—Form of body closely approximating to that of *Gnathophausia zoëa*. Dorsal spine very large, finely serrate, both at the dorsal and lateral edges. Rostrum exceedingly elongate and slender, almost twice the length of the carapace, and coarsely denticulate. Supra-orbital spines strongly developed; antennal spines obsolete; branchiostegal spines well marked, triangular, and projecting straight outward. Five anterior caudal segments slightly keeled above, and produced at the middle of the posterior margin into small dorsal denticles; posterior lappet of epimera acuminate, that on the second segment remarkably produced. Anterior section of last segment with two epimeral spines on either side. Eyes short, claviform. Antennal scale remarkably large, with terminal lobe very narrow, the spine of the outer corner exceedingly strong, mucroniform, and greatly surpassing the terminal lobe, coarsely denticulate on both edges, the denticles being continued along the outer margin of the scale almost to its base. Telson and uropoda almost the same as in *Gnathophausia zoëa*. Length reaching 59 mm.

Remarks.—This species, at the first glance, much resembles *Gnathophausia zoëa* in appearance, but may readily be distinguished from it by the still more elongate rostrum, the closely denticulate dorsal spine, the absolute want of antennal spines, the branchiostegal projections being very distinctly marked; and, finally, by the strong development of the antennal scale, and more particularly of the spine issuing from its outer corner.

Description.—Of this species also, no less than five specimens were collected, all in the same locality. One is a female, the remainder being males. The largest

specimen, a male, reaches a length of 59 mm. I have selected a male for anatomical dissection, and have figured the limbs, gills, and the nervous system separately on Pl. VIII., hoping in this way to illustrate more closely the organisation of the genus.

The form of the body (see Pl. VII. figs. 1, 2), although rather similar to that in *Gnathophausia zoëa*, would appear on the whole to be somewhat more slender, the anterior division being less tumid.

The carapace, as in that species, covers the whole of the trunk, without, however, overlapping the anterior part of the first caudal segment. The dorsal spine is strongly developed, projecting, when the tail is extended, to about the end of its fourth segment. It is closely denticulate throughout, the denticles being present not only, as in *Gnathophausia zoëa*, along the lateral, but also on the dorsal edges, and continued forward, moreover, along the dorsal keel of the carapace almost to the verge of the dorsal area. The lateral keels of the carapace are comparatively shorter than in *Gnathophausia zoëa*, but, in other respects, exhibit a perfectly similar appearance. The rostrum is exceedingly elongate and slender, even attaining twice the length of the carapace, and it is perfectly straight, acuminate, and coarsely denticulate throughout. The supra-orbital spines (fig. 5, *a*), as in *Gnathophausia zoëa*, are strongly developed, projecting far beyond the eyes. On the other hand, the antennal spines would seem to be wholly wanting, only a very small rounded prominence (*b*) being observed in their place. The lateral expansions of the carapace, too, project into a strong, acutely triangular lappet, pointing straight outward, and apparently corresponding to the branchiostegal spines.

The five anterior caudal segments are, as in *Gnathophausia zoëa*, slightly keeled above, and exhibit in the middle of the posterior margin a small dorsal projection pointing backward. The epimera project distinctly, the posterior lappet being drawn out into a sharp point, which, on the second segment, is remarkably long and slender. The epimeral plates issuing from the anterior section of the last segment exhibit two small denticles succeeding each other. The terminal spines, placed on each side of the base of the telson, are unusually strong and somewhat upturned.

The eyes, as in *Gnathophausia zoëa*, are rather short and clavate in form.

The antennal scale (Pl. VII. fig. 3), on the other hand, exhibits a rather characteristic appearance. It is very large, and tapers rapidly toward the apex, the terminal lobe being very much narrowed and lanceolate in form. The spine, too, issuing from the outer corner, is enormously developed, decidedly mucroniform, and projects far beyond the tip of the scale; it is also coarsely denticulate on both edges, the denticles, moreover, being continued backward along the outer margin of the scale, almost to its base.

The telson (fig. 4) does not differ materially from that of *Gnathophausia zoëa*, nor do

the several other parts show any essential difference from what is observed in that species.

Habitat.—All the specimens of this species were collected in the same locality, viz., off Samboangan, Mindanao (Philippine Islands).

Station 200, October 23, 1874; lat. 6° 47′ N.; long. 122° 28′ E.; depth, 250 fathoms; green mud.

Section 3.—Infero-posterior corners of carapace produced into two spines. Dorsal spine distinctly projecting. Dorsal keel interrupted anteriorly. Supra-orbital spines small. Antennal scale jointed at apex, outer edge jutting out anteriorly into a strong spine. Maxillipeds with distinctly developed exopodites. Epimeral plates of last segment not united on the ventral face.

11. *Gnathophausia gracilis*, Willemoes-Suhm (Pl. VII. figs. 6–10).

Gnathophausia gracilis, Suhm, Trans. Linn. Soc. Lond. (Zool.), ser. 2, vol. i. p. 33, pl. ix. fig. 1, 1875.

Gnathophausia gracilis, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 11.

Specific Characters.—Form of body very slender. Carapace not very large; dorsal spine short, but distinctly projecting; infero-posterior corners armed with two unequal spines, the upper one being the stronger, and about equalling in length the dorsal spine. Upper lateral keel wanting. Dorsal keel armed in its posterior part with coarse, anteriorly curved denticles. Cervical sulcus distinctly defined. Rostrum elongate and slender, equalling the carapace in length, and distinctly denticulate. Supra-orbital spines very small, and not defined from the base of the rostrum. Antennal spines well-marked; branchiostegal projections exceedingly large, acutely triangular. The two anterior caudal segments with strong dorsal projections; epimera small. Eyes very narrow, cornea scarcely at all expanded. Antennal scale rather slender, terminal lobe small, outer edge serrate in the distal part, spine of outer corner slightly projecting. Telson linguiform, apical projection quadridentate, having besides a small lateral denticle. Length, 41 mm.

Remarks.—This is a rather anomalous species, perhaps most nearly related to the species comprised in the first section, although the antennal scale is developed in the same manner as in the species belonging to the second section. After all it cannot be referred to either of these two sections, but should more properly be regarded as the type of a third section, or subgenus.

Description.—The sole specimen obtained by the Challenger Expedition, and briefly described by the late Dr. v. Willemoes-Suhm, does not appear to have been very carefully handled, being in far from a good state of preservation, the carapace having been partly crushed and disengaged from the body. It has therefore been somewhat difficult for me

to work out the specific characters satisfactorily, as also to give correct figures of the general appearance and form of the body. The specimen has not a trace of incubatory lamellæ, and hence is most likely a male. Its length is only 41 mm.

The form of the body (figs. 6, 7), as compared with the other species of the genus, is very slender, for which reason the late Dr. v. Willemoes-Suhm suggested the specific denomination "*gracilis*."

The carapace is comparatively small, and does not seem to cover completely the last segment of the trunk. It projects posteriorly into a well marked, although rather short, dorsal spine, scarcely reaching beyond the first caudal segment. The infero-posterior corners of the carapace, instead of being rounded off, as in the species belonging to the second section, are somewhat prominent, and jut out into two posteriorly directed spines, of somewhat unequal length, the lower rather short, whereas the upper attains about the length of the dorsal spine. Of the lateral keels, the lower only is distinctly developed, and it runs parallel to the inferior margin of the carapace, terminating at the base of the upper spine, which issues from the infero-posterior corner. Of the upper lateral keels, on the other hand, no trace whatever can be discerned. The dorsal keel is interrupted in the anterior part of the carapace, where a distinct transverse impression is seen to occur, apparently corresponding to the cervical sulcus in other Schizopoda. In the posterior part, however, the keel is well marked, and armed with a row of strong, anteriorly curving denticles. The rostrum is rather elongate and slender, about as long as the carapace, and, as in the other species, three-edged, being also armed with strong denticles, continued along the dorsal edge to some distance posterior to the base of the rostrum. The supra-orbital spines are very small, and not distinctly defined from the base of the rostrum, being placed somewhat anterior to the insertion of the eyes. The antennal spines are well marked, though not very large. On the other hand, the branchiostegal spines are enormously developed, and project on either side as strong wing-like expansions, tapering to a sharp point.

The caudal segments are rather slender, and the five anterior ones are armed with dorsal projections, those on the two foremost being distinguished by their exceedingly large size. On the second segment occur two such projections, of an acutely triangular form, both placed in the middle line, and pointing the one posteriorly, the other anteriorly. On the first segment may also be observed two projections, of which, however, the anterior is very small, whereas the posterior is rather large, and points straight upward. On the other segments, only a small projection is seen in the middle of the posterior margin. The epimeral plates issuing from the anterior section of the last segment are, as in *Gnathophausia longispina*, armed with two small denticles.

The eyes are very small and narrow, the cornea being scarcely expanded, and only occupying the outermost extremity of the eye.

The antennulæ do not seem to exhibit any essential difference from those in other

species of the genus, except, perhaps, that the inner flagellum is comparatively smaller, not nearly reaching the length of the antennal flagellum.

The antennal scale (fig. 8) is about twice as long as the antennular peduncle and rather narrow, almost three times as long as broad, but in other respects exhibiting a structure similar to that observed in the species belonging to the second section of the genus, the terminal part being marked off from the remaining portion of the scale by a distinct oblique suture, and jutting out into a short linguiform lobe. The inner edge of the scale is very slightly arched, and, like the terminal lobe, fringed by a row of comparatively strong bristles. The outer edge, too, is almost straight, and in its distal half slightly serrate, projecting anteriorly into a naked spine of moderate length.

With regard to the oral parts, they cannot of course be accurately examined in the solitary specimen obtained, but would seem on the whole to agree with those in *Gnathophausia longispina*, as described above; with this difference, however, that the maxillipeds, as in the three species belonging to the first section, have distinctly developed exopodites.

The legs and caudal limbs do not exhibit any essential difference from the same parts in the other species of the genus.

The telson (see fig. 9) exhibits the usual linguiform shape, and its length about equals that of the two preceding segments taken together. Its lateral edges are evenly curved in their distal part, and densely spinulose. The apical projection exhibits a form somewhat different from that in the other species (see fig. 10), being drawn out into four acute terminal lappets, or spines, the two outer ones being the largest and smooth, whereas the two inner ones are denticulate along the inner edge, and separated by an angular cleft. Moreover, a short denticle is observed on either side at the outer edge of the projection.

The uropoda (*ibid.*) do not quite reach the tip of the telson, and they exhibit the usual structure, the outer plate being the larger, and having the terminal part marked off as a distinct joint, jutting out in the form of a rather large linguiform lobe, densely fringed with bristles. The outer edge of this plate is considerably less arched than in the other species, and terminates in a very small denticle.

Habitat.—The specimen described above, together with *Gnathophausia affinis*, was taken in the tropical part of the Atlantic Ocean between Africa and Brazil.

Station 107, August 26, 1873; lat. 1° 22′ N., long. 26° 36′ W.; depth, 1500 fathoms; Globigerina ooze; bottom temperature, 37°·9.

Genus 4. *Chalaraspis*, Willemoes-Suhm (*ex parte*).

Generic Characters.—Carapace thin, membranous, of enormous size, covering, in addition to the trunk, the anterior part of the tail, and projecting forwards as a broad frontal plate. Caudal segments with rounded epimera. Eyes small. Antennular

peduncle short and thick, inner flagellum very small. Antennal scale not jointed, outer edge serrate. The two (?) anterior pairs of legs differ slightly from the rest, which are uniform in structure, and true pereiopoda. Telson prolonged, acuminate. Outer plate of uropoda not jointed at apex.

Remarks.—The specimen from which the present genus is established has unfortunately been lost. But to judge from the drawings of the animal made by the late Dr. v. Willemoes-Suhm, it certainly claims to be regarded as the type of a distinct genus among the Lophogastridæ. The generic name *Chalaraspis* has, it is true, been also adopted by that author for another very different Schizopod—*Chalaraspis unguiculata;* but as that form has proved to be identical with Dana's *Eucopia australis*, I have thought fit to retain the generic denomination proposed by Dr. v. Willemoes-Suhm for the remarkable form here treated of, the name being, moreover, a most appropriate one.

12. *Chalaraspis alata*, Willemoes-Suhm MS. (Woodcuts 1, 2).

Specific Characters.—Form of body rather short and thickset. Carapace without either keels or sculpturing, emarginate behind, wholly covering the two anterior segments of the tail, as also a part of the third segment. Cervical sulcus distinct. Frontal plate abruptly truncate, anterior margin finely serrate. Eyes very small and narrow. Antennular peduncle projecting with its two outer joints beyond the frontal plate. Antennal scale not very large, of an oval form, apex rounded. Telson, equalling in length the three

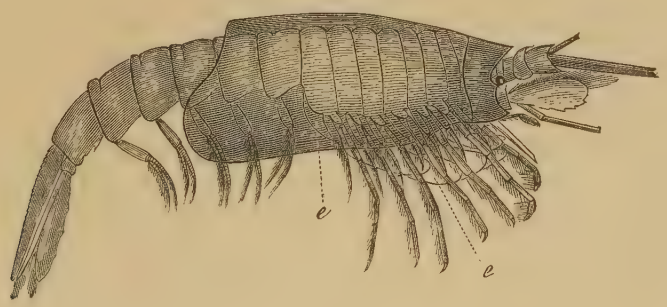

Fig. 1.—*Chalaraspis alata*, Suhm.

preceding segments taken together, rather narrow, and tapering towards the apex. Length, 40 mm.

Remarks.—As above stated, the only specimen obtained by the Challenger Expedition has been lost, and hence I have not myself been enabled to submit the species to a detailed examination. However, the two drawings of this interesting form were fortunately found among the manuscripts of the late Dr. v. Willemoes-Suhm,—the one

exhibiting the animal from the right side, the other as seen from above. The accompanying woodcuts have been executed with the greatest possible accuracy from these drawings, and in the following description are also embodied certain manuscript notes by the same author.

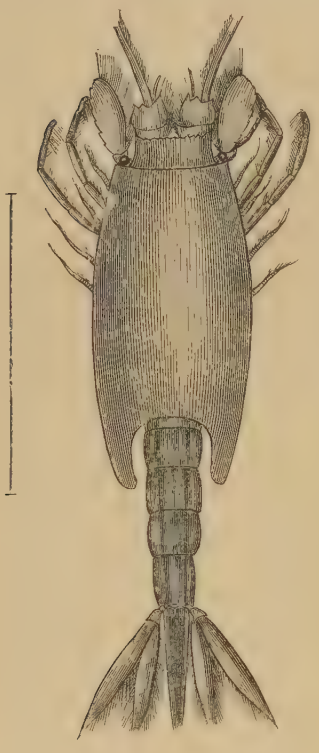

Fig. 2.—*Chalaraspis alata*, Suhm.

Description.—The specimen has, according to the late Dr. v. Willemoes-Suhm, a length of 40 mm., of which the carapace, measured along the upper face, occupies 20 mm.

The form of the body, as will be seen from the figures, is comparatively short and thickset, even more so than in the species of the genus *Gnathophausia*.

The carapace is enormously developed, covering not only the whole of the trunk, but also a very considerable part of the tail, of which the two anterior segments are completely concealed beneath it. It is very thin, membranous, and semi-transparent, and does not exhibit any trace of keels or other sculpturing, nor jut out distinctly into spines. Throughout by far the greater part of its extent, it loosely covers the body like a mantle, being connate with it in its most anterior part only. Posteriorly, it is deeply emarginate, the lateral parts forming broadly rounded and very deep wing-like expansions, overlapping the third caudal segment, and more or less completely concealing at the sides the three anterior pairs of caudal limbs, as also the basal parts of the legs. Anteriorly, it projects as a short, but very broad, frontal plate, abruptly truncate at the extremity, the anterior margin being slightly emarginate and finely serrate, the lateral corners somewhat extended. At a short distance behind the frontal plate a distinctly marked transverse suture occurs, apparently corresponding to the cervical sulcus in other Schizopods. The antero-lateral corners of the carapace form an acute angle. No supra-orbital, antennal, nor branchiostegal spines can be detected.

The caudal segments appear somewhat compressed, and exhibit a slight transverse impression close to the posterior margin. The epimera are evenly rounded, as in *Lophogaster*. The last segment would not seem to be subdivided transversely, and it has a small epimeral spine on either side.

The eyes are very small and narrow, with the cornea but slightly expanded; they project a little on either side of the frontal plate.

The antennular peduncle is short and thick, the basal joint being wholly concealed beneath the frontal plate, whereas the two outer joints project beyond its anterior margin. As in *Gnathophausia*, the last joint juts out on the inner side as a densely setigerous

lobe, pointing forward. Of the flagella, the inner one would seem to be very small, whereas the outer is strongly developed.

The antennal scale is comparatively small, and has no articulation at the extremity. It is oval in form, the apex being rounded off, and the outer edge distinctly serrate.

Of the legs, the two anterior pairs, judging from the figures, would appear to differ somewhat from the rest, their terminal part being a little stronger and more curved. The remaining legs are uniform in structure and not very strong, but have a distinct terminal claw.

The incubatory lamellæ (Fig. 1, *ee*) were well marked in the specimen examined, and were present, as in the other forms of this family, at the bases of all the legs.

The caudal limbs would not seem to differ in structure from those of other Lophogastridæ.

The telson is greatly produced, and very narrow, tapering gradually towards the apex, which is acutely pointed; the lateral edges are almost straight, and in one of the figures appear finely serrate.

The uropoda are rather large, reaching the tip of the telson, and have both plates lanceolate, the outer one being somewhat broader, without, however, exhibiting any articulation at the apex.

Habitat.—The above described specimen was taken in the Southern Ocean, south of Australia.

Station 158, March 7, 1874; lat. 50° 1′ S., long. 123° 4′ E.; depth, 1800 fathoms; Globigerina ooze; bottom temperature, 33°·5.

Family II. Eucopiidæ.

Remarks.—This family, so far as at present known, contains but a solitary type, viz., the genus *Eucopia*, established by Dana for a remarkable Crustacean obtained by the United States Exploring Expedition, and named by that author *Eucopia australis*. This form was classed by Dana within his division Penæidea, and Mr. Spence Bate has recently [1] adopted the same view in regard to the systematic position of the genus. On the other hand, the late Dr. v. Willemoes-Suhm, who rediscovered the same species during the Challenger Expedition, regarded it as the type of a new family of the Schizopoda. But, having apparently not consulted Dana's work, he described the animal as a new form under the name of *Chalaraspis unguiculata*, and accordingly named the family Chalaraspidæ. In my opinion, the view of Dr. v. Willemoes-Suhm, as to the systematic position of the present form, is undoubtedly quite correct. The earlier name, however, *Eucopia*,

[1] On the Penæidea, *Ann. and Mag. Nat. Hist.*, ser. 5, vol. viii. pp. 169–196, 1881.

proposed by Dana, must be retained, and the family hereafter named Eucopiidæ, in lieu of Chalaraspidæ.

The schizopodous nature of *Eucopia* is apparent both in the powerfully developed natatory branches (exopods) of all the legs, and more particularly in the marsupial pouch of the female, the latter exhibiting precisely the same structure as the same part in the Lophogastridæ. Indeed this last character alone would suffice to distinguish the species as a true Schizopod, no other Podophthalmians possessing, as stated above, a similar characteristic. Moreover, the structure of the oral parts would seem to bear out this assumption, for they are, on the whole, rather similar to those in other true Schizopods. Thirdly, the structure and arrangement of the gills exhibit a striking resemblance to those of the corresponding parts in the Lophogastridæ. On the other hand, however, the very peculiar and anomalous form of the legs would apparently prevent us from ranging this Crustacean within any of the three previously established families of Schizopoda, and for this reason I have seen fit to adopt the view of the late Dr. v. Willemoes-Suhm in regarding it as the type of a separate family.

Genus *Eucopia*, Dana, 1852.

Eucopia, Dana, United States Exploring Expedition, Crustacea, part i. p. 609.
Chalaraspis, Suhm (*ex parte*).

Generic Characters.—Integuments very thin and soft, membranous. Carapace large, covering whole of trunk, deeply emarginate posteriorly, lateral wings produced along the sides of tail; frontal part rounded off, not rostrate. Caudal segments without distinct epimera, smooth. Eyes imperfectly developed. Antennular peduncle rather stout, inner flagellum very small, outer strongly developed. Antennal scale large, jointed at apex. Mandibular palp very slender. Maxillæ rather feeble in structure; first pair without any palp, second pair with very small masticatory lobes, provided with only simple bristles. Maxillipeds furnished with an imperfectly developed exopodite, the epipodite exceedingly large. The three anterior pairs of legs short and strong, developed as gnathopoda; the three succeeding pairs exceedingly slender and elongate, with propodal joint slightly expanded and terminal claw very mobile; last pair filiform, outer part setose. Branchiæ well developed, consisting of three bipinnate ramifications, the inner one projecting beneath the ventral face, the two others covered by the carapace. Pinnulæ of gills irregularly lobular. No branchiæ at base of last pair of legs. Marsupial pouch composed of seven pairs of incubatory lamellæ. Telson rather large, tapering; apex entire, not incised. Outer plates of uropoda jointed at apex.

Remarks.—The genus does not, in my opinion, at present comprise more than a single species, described in detail below. Mr. Spence Bate having examined some of the specimens from the Challenger Expedition, does indeed suggest that one of these is

the representative of a new species, to which he assigns the name of *Eucopia equatoria*, but after a careful examination of this, I feel convinced that it ought to be regarded as a male of *Eucopia australis*, the assumed specific differences being readily accounted for as mere sexual characters.

13. *Eucopia australis*, Dana (Pls. IX. and X.).

Eucopia australis, Dana, United States Exploring Expedition, Crustacea, part i. p. 609; Atlas, pl. xi. fig. 10, *a* to *m*.
Chalaraspis unguiculata, Suhm, Trans. Linn. Soc. Lond. (Zool.), ser. 2, vol. i. p. 37, pl. viii., 1875.
Eucopia australis, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 12.

Specific Characters.—Form of body rather slender, tail tapering backward very considerably, with last segment very elongate. Carapace indistinctly areolate in its anterior part, cervical and branchiostegal lines well marked; lateral wings rounded off at the tip and projecting far beyond the first caudal segment. Frontal margin evenly arched. A slight infra-orbital projection present, but no trace of supra-orbital, antennal, or branchiostegal spines. Eye small, cornea scarcely expanded at all; in male somewhat larger, with darker pigment. Last joint of antennular peduncle produced interiorly into a setiferous lobe. Antennal scale oblong-ovate, apex rounded, outer edge somewhat sinuous, and terminating in a very small denticle. The three anterior pairs of gnathopodous legs in male rather stronger than in female, the propodal joint being greatly swollen; the three succeeding pairs of legs attaining almost the length of the whole body, propodal joint slightly dilated and strongly spinous at the distal part of its inner edge, terminal claw scarcely half as long, straight and spinous at base. Terminal part of telson fringed with unequal spinules, the apex being armed with two straight spines, between which two small bristles are attached. Uropoda attaining length of telson, outer plate obliquely truncate at apex, with three small denticles at the end of the straight outer edge. Length reaching 50 mm.

Remarks.—There cannot, I think, be any doubt whatever that this form is identical with Dana's *Eucopia australis*. The author in question, it is true, does not describe the very peculiar structure of the three pairs of legs preceding the last, but merely remarks that the four posterior pairs are very long and slender, from which it might be inferred that all these pairs have had a uniform appearance in Dana's specimen. It must, however, be borne in mind that the solitary example described by Dana was not in a very good state of preservation, having been taken from the stomach of a penguin, and Dana, moreover, states, that the four posterior pairs of legs were partly broken. In all other respects the figures and description of Dana agree sufficiently well with the form here treated of, and described by the late Dr. v. Willemoes-Suhm under the name of *Chalaraspis unguiculata*.

Although the present species would seem to be widely distributed, and a rather plentiful supply of specimens was collected by the Challenger Expedition, it has proved a matter of no small difficulty to make out its anatomy and to arrive at a correct idea of the general appearance of the animal, most of the specimens, owing to their great fragility, being in a rather imperfect state of preservation, and having lost a more or less considerable number of their limbs. However, by comparing all the specimens, and supplying from one what is wanting in another, I have finally succeeded in attaining a tolerably complete knowledge of the organisation of this remarkable Crustacean, and at the same time have been enabled to confirm the statements of the late Dr. v. Willemoes-Suhm, as to certain important characteristics omitted in the description given by Dana.

Description.—The length of the largest specimen, a female with remarkably developed marsupial pouch, is 50 mm.

All the integuments are very thin and soft, almost membranous, and hence the general form of the body has in most cases been somewhat altered by the action of the spirit or by accidental pressure.

In the best preserved specimens, the body exhibits (see Pl. IX. figs. 1, 2; Pl. X. fig. 1) a rather slender form, the anterior division being almost cylindrical, the posterior tapering rapidly towards the end.

The carapace is very large, and, as in *Gnathophausia*, connate with the body in its most anterior part only, but otherwise loosely covering the trunk, all the segments of which are distinctly defined in their whole circumference (see Pl. X. fig. 2), the last being perceptibly larger than the others. It is deeply emarginate posteriorly, without, however, as stated by Dana, leaving any of the segments of the trunk uncovered. The lateral wings are rather produced, and rounded at the tip, extending laterally along the anterior part of the tail and reaching far beyond its first segment, in some specimens almost to the end of the second (see Pl. IX. fig. 1). The inferior margins, too, are very slightly arcuate, covering in part the bases of the legs, and terminating anteriorly in an obtuse angle. The anterior part of the carapace exhibits above an indistinctly areolate appearance, two transverse depressions, one of which may be the cervical sulcus occurring here, partly crossed by a slight longitudinal depression on either side. Moreover, the branchiostegal line, marking off the linguiform dorsal area, is distinctly perceptible (see Pl. IX. figs. 1, 2). The frontal margin is evenly curved, not forming any rostral projection, and leaving the ocular segment uncovered. Beneath and somewhat external to the eyes, on either side, a slight projection is seen, apparently corresponding to the infra-orbital spine in other Podophthalmians. On the other hand, no trace whatever can be found of either supra-orbital or of antennal and branchiostegal spines.

The caudal segments do not exhibit any distinctly developed epimera, being evenly rounded both ventrally and dorsally. They rapidly diminish in breadth posteriorly, and

the last segment is very much compressed, as also exceedingly elongate, equalling in length the three preceding segments taken together.

The eyes (see Pl. IX. fig. 3) in the female are very small, and nearly cylindrical, with the cornea not in the least expanded, and are furnished with a whitish pigment. The visual elements would also seem to be most imperfectly developed. In the male (see Pl. X. fig. 13) the eyes are rather larger and thicker, with a darker pigment, but here, too, the visual elements do not exhibit any complete development. Both in the male and the female a distinctly marked ocular papilla is seen projecting anteriorly over the upper part of each cornea. The ocular segment projects anteriorly as a broadly rounded lobe, reaching a trifle beyond the insertion of the eyes (see Pl. IX. fig. 3).

The antennular peduncle (see Pl. IX. fig. 3) is rather stout, and somewhat flattened throughout. Its basal joint is almost as large as the two other joints taken together, and finely setiferous along the inner edge, as also partly on the upper face; its outer edge exhibits a few (three) somewhat stronger plumose bristles, and terminates in an almost perfect right angle, from which proceed a bundle of similar bristles. The second joint is rather short, and connected with the last by a very oblique suture, running from without inwards. The last joint has the inner edge sharpened and projecting anteriorly as a triangular lobe, with a fringe of dense and very long plumose bristles, carried along the whole of the inner margin. The inner flagellum is very small, only slightly exceeding the peduncle in length. The outer, on the contrary, is most powerfully developed, equalling, it may be, the whole body in length. In none of the specimens, however, is the outer flagellum quite complete, a more or less considerable portion being invariably broken off.

The antennal scale (see Pl. IX. fig. 4) is rather large, projecting far beyond the antennular peduncle, and in form is somewhat oblong-ovate, slightly tapering toward the apex. The outer edge is a trifle arched in its proximal part, and terminates in a very small dentiform projection; the inner edge is very slightly arcuate, and the apex forms a broadly rounded lobe, marked off from the remaining part of the scale by a distinct oblique suture, and fringed with a dense row of long bristles, carried along the entire inner edge of the scale. The flagellum is strongly developed, the basal part consisting as usual of three joints,—the last by far the largest,—and the terminal part, according to the statement of the late Dr. v. Willemoes-Suhm, even exceeding the whole of the body in length.

The anterior lip (see Pl. IX. fig. 5) forms a rounded triangular prominence, somewhat narrower than the same part in *Gnathophausia*.

The posterior lip (fig. 8) has the lateral lobes somewhat expanded and irregularly rounded off, their inner edges being finely ciliated.

The mandibles (see fig. 5) exhibit, in respect of their body, a structure very similar to that in the Lophogastridæ, the cutting edge being irregularly and coarsely dentate, and exhibiting, moreover, a small molar area posteriorly. The palp, on the other hand, is very

slender and elongate, almost twice as long as the body, the middle joint being much the largest, and furnished on both edges with slender bristles. The last joint is rather small, scarcely attaining one-third of the length of the middle joint, and having the distal part of the inner edge slightly emarginate, and armed with a dense row of bi-articulate spinules, and likewise with a series of simple bristles.

The first pair of maxillæ (fig. 9) are rather small, without any trace of a palp or an exognath. Of the two masticatory lobes, the outer is much the stronger, and is armed at the abruptly truncated tip with a double row of strong spines (fig. 10). The inner lobe is exceedingly small, triangular, and furnished with a single apical seta, as also a few very small bristles on the outer margin.

The second pair of maxillæ (fig. 11) are decidedly membranous throughout, exhibiting a structure most resembling that in *Lophogaster*. As in that genus, the palp is very small, although distinctly bi-articulate. The masticatory lobes are unusually short, and, as is also the case with the outer joint of the palp, provided with but a few simple bristles. The outer lobe is slightly bifurcate at the apex. The exognath is very large, elliptical, and fringed with a dense row of very strong, plumose setæ. No projection could be observed at the outer side of the basal part.

The maxillipeds (fig. 12) exhibit on the whole a structure very similar to that in *Lophogaster*, but appear somewhat more membranous. The basal part is rather broad, and filled up with the strong muscles giving movement to the epipodite. The five-jointed, incurving terminal portion, or palp, is scarcely as long as the basal part, and setose on both margins. Its last joint (dactylus) terminates in a strong spine, and is provided, at the inner edge, with three smaller spines, and also a few short bristles. The exopodite is rather small, and has the form of a simple, narrow plate, fringed with plumose setæ. The epipodite, on the other hand, is enormously developed, lanceolate in form, and of a very soft and almost spongy structure.

The legs, as stated above, exhibit a very peculiar structure, and are, contrary to what is observed in other Schizopods, rather dissimilar in appearance. All, however, having powerfully developed natatory branches, or exopods, point out their schizopodous nature.

The three anterior pairs of legs (see Pl. IX. figs. 13, 15, 17) are rather short and powerful in structure, generally inclining toward the oral parts, and from this feature they would seem to be endowed with the function of true gnathopoda. They increase somewhat in length posteriorly (see fig. 1), the anterior pair, corresponding to the gnathopoda in other Schizopoda, being less powerfully developed and more membranous in structure than the two remaining pairs; they are also furnished with longer bristles. In all of them the basal joint is somewhat produced, transversely oval, constituting with the remaining part of the leg a strong elbow-shaped curve. The carpal joint is rather elongate, and furnished in the two anterior pairs (figs. 13, 15), at the distal part of the

inner edge, with a dense row of slender spinules, in addition to the usual bristles. The propodal joint in the first pair (fig. 13) is quite simple, and scarcely dilated at all, forming therefore no palmar margin. In the two succeeding pairs (figs. 15, 17), however, this joint is conspicuously dilated, and forms, at the end of the inner edge, a more or less distinctly marked palmar margin (figs. 16, 18). The terminal joint or dactylus, in the first pair (fig. 13), is almost straight, in the two other pairs (figs. 16, 18), on the contrary, strongly curved, and denticulate at the inner edge, as also very mobile, admitting of being bent in toward the palmar margin of the propodus. In the male, these two pairs of legs (see Pl. X. figs. 14, 16) are much more powerful than in the female, the propodus being exceedingly dilated and filled up with strong muscles moving the curved dactylus.

The three succeeding pairs of legs (see Pl. X. figs. 1, 5) are very remarkable, not only by reason of their extraordinary length and slender form, but on account of their anomalous structure. They almost equal the whole body in length, if the caudal fan be excepted, and, in the specimens preserved in spirit, generally exhibit a strong elbow-shaped curve at the junction between the ischial and meral joints, the proximal section of the legs being more or less directed backward, whereas the terminal section extends at right angles with it anteriorly, reaching far in advance of the fore part of the body (see Pl. X. fig. 1). They all exhibit a very similar structure, except that the basal joint diminishes rapidly in length posteriorly, while the terminal section of the leg in a corresponding degree increases in length, though more slightly. Hence they all reach, when stretched out anteriorly, to about the same transverse line. Of the several joints, the basal one is quite remarkable for its considerable length, more especially in the first of the above pairs (fig. 5). The proximal part of this joint is somewhat dilated, and strongly curved, whereas the distal part is very slender, and, in the first of these pairs, projects even far beyond the tip of the exopod. The ischial joint is comparatively short, and somewhat dilated at the end, where it contains the muscles moving the terminal section of the leg. This is exceedingly slender, and, like the remaining part, but very sparingly beset with short bristles. The meral joint is a trifle longer than the carpal, and somewhat curved. The propodus, too, is somewhat shorter than the carpus, and slightly dilated at the base, tapering toward the apex, and exhibiting at the distal part of the inner edge a distinctly marked palmar margin, armed with long, slender spines. The terminal joint, finally, forms an exceedingly movable, almost straight, claw, spinulose at the inner half, and admitting of being bent closely in towards the palmar margin. As to the function of these peculiarly formed legs, it is difficult to form a definite opinion, without having observed the living animal. They would not seem to be specially adapted for the usual ambulatory motion, but are more likely used for the purpose of seizing hold of any delicate submarine objects, as Hydroids or Crinoids, fixed at the sea bottom.

The last pair of legs (see Pl. X. fig. 2) are rather elongate, though falling considerably short of the length of the three preceding pairs, nor do they exhibit their

very slender form. They are nearly of the same thickness throughout, and rather abundantly furnished with bristles. The terminal joint has not the appearance of a claw, but is linear in shape, and very densely setigerous, more especially at the inner edge, the apex being obtusely rounded.

The gills (see Pl. X. fig. 2) occur at the bases of all the legs, except the last, and present alike in their arrangement and structural details a great resemblance to the same organs in *Gnathophausia*. They are divided into three principal branches, the largest bent in towards the ventral face (see Pl. IX. fig. 14), whereas the two others are wholly covered by the lateral parts of the carapace. Every branch is more or less distinctly bipinnate, and the pinnulæ are divided into numerous rather irregularly disposed, lobular projections (see Pl. X. fig. 3). In the interior of the lobules small opaque granular bodies are scattered, apparently blood-cells, similar to those observed within the several oral parts, and also to some extent within the legs. In the male, the gills (see Pl. X. figs. 14, 16) are, on the whole, precisely similar to those in the female, excepting that the inner branch (fig. 15) is somewhat larger and more decidedly arborescent, the pinnulæ being in part subdivided.

The marsupial pouch in one of the specimens obtained (Pl. IX. fig. 1) is very large, and projects considerably beneath the trunk. As in the Lophogastridæ, it is composed of seven pairs of large ovato-lanceolate lamellæ, setigerous at their edges (fig. 15), and each overlapping the other in the median line.

The caudal limbs (Pl. X. fig. 8), as in the Lophogastridæ, are developed in both sexes into powerful natatory organs, the terminal branches very slender and subdivided into numerous short setigerous joints. In the male these limbs (fig. 17) are somewhat more strongly developed than in the female, the basal part being rather more dilated, and exteriorly jutting out into a rounded lobe. In both sexes the inner branch is a trifle shorter than the outer.

The telson (see Pl. X. fig. 9) is rather elongate and slender, gradually tapering in its outer part toward the apex, which is narrowly truncate. The lateral edges of the telson are in the distal part armed with a row of rather strong but somewhat unequal spinules, and two similar but considerably longer ones occur on the apex, in addition to two small bristles in the middle.

The uropoda (*ibid.*) somewhat exceed the telson in length, and have the inner plate lanceolate, the outer rather broader and obliquely truncate at the apex, or projecting as a short terminal lobe, marked off from the plate by a distinctly defined transverse suture. The outer edge of this plate is perfectly straight and bare, terminating in an obtuse angle, from which issue three short denticles (see fig. 11).

The caudal fan of the male agrees precisely in all its details with that of the female.

Nervous System.—In extracting the ventral cord from the specimen selected for anatomical examination, I failed to discover more than seven ganglia belonging to the

anterior division of the body (see Pl. X. fig. 12), and therefore at first supposed the foremost to have been very possibly lost in dissection. Subsequently, however, I learnt that Mr. Spence Bate, too, did not find a greater number in the specimen he dissected, and, moreover, that this zoologist has found the last segment of the trunk to want a separate ganglion, a feature likewise shown to characterise several forms of the Penæidea. The ganglion belonging to the penultimate segment of the trunk, according to the statement of the same author, besides furnishing that segment and its appendages with nerves, also sends off on each side a nerve to the last pair of legs. Hence, the total number of ventral ganglia belonging to the anterior division of the body, counting those that supply the oral parts with nerves as one, would not strictly be more than seven.

In regard to the structure of the ganglia (see Pl. X. fig. 12) they exhibit, as in *Gnathophausia*, a very similar appearance, forming rounded masses of granular nerve-substance, connected by distinct fibrous commissures. Those of the anterior division of the body are perfectly uniform in size, and somewhat larger than the caudal ganglia. The commissures, too, connecting the ganglia of the trunk are rather thick, and lie close together in such a manner as readily, at the first glance, to be taken for single, while those between the caudal ganglia are distinctly separated and rather long. In addition to a strong nerve-trunk, proceeding from either side of the ganglia and supplying the corresponding pair of limbs with nerves, another pair of nerves is seen to originate from the commissures themselves, apparently innervating the muscles of the body.

Colour.—According to the statement of the late Dr. v. Willemoes-Suhm, the animal exhibits, in a fresh state, a bright red colour throughout.

Habitat.—The specimens procured by the Challenger Expedition were collected from the following seven localities:—

Station 50, May 21, 1873; lat. 42° 8′ N., long. 63° 39′ W. (North Atlantic, south of Nova Scotia); depth, 1250 fathoms; blue mud; bottom temperature, 38°·0.

Station 73, June 30, 1873; lat. 38° 30′ N., long. 31° 14′ W. (North Atlantic, west of the Azores); depth, 1000 fathoms; Pteropod ooze; bottom temperature, 39°·4.

Station 92, July 26, 1873; lat. 17° 54′ N., long. 24° 41′ W. (Tropical Atlantic, north of the Cape Verde Islands); depth, 1975 fathoms; Globigerina ooze.

Station 107, August 26, 1873; lat. 1° 22′ N., long. 26° 36′ W. (Tropical Atlantic, about midway between Africa and Brazil); depth, 1500 fathoms; Globigerina ooze; bottom temperature, 37°·9.

Station 146, December 29, 1873; lat. 46° 46′ S., long. 45° 31′ E. (Southern Ocean, between Cape of Good Hope and Kerguelen); depth, 1375 fathoms; Globigerina ooze; bottom temperature, 35°·6.

Station 158, March 7, 1874; lat. 50° 1′ S., long. 123° 4′ E. (Southern Ocean,

south of Australia); depth, 1800 fathoms; Globigerina ooze; bottom temperature, 33°·5.

Station 237, June 17, 1875; lat. 34° 37′ N., long. 140° 32′ E. (North Pacific, off Kanagava, Japan); depth, 1875 fathoms; blue mud; bottom temperature, 35°·3.

It should, however, be stated that, in all probability, this form was observed during the course of the Expedition in many localities other than those enumerated above. But the great fragility of the animal may in most cases have rendered the specimens, when brought up in the dredge or trawl, so very defective as apparently to leave them worthless for preservation. Thus the late Dr. v. Willemoes-Suhm says, he was "almost sure to get at least a fragment of this Crustacean whenever, in the Mid Atlantic, true deep-sea animals came up in the dredge or trawl."

The specimen described by Dana was from the Antarctic Ocean, lat. 66° 12′ S., long. 149° 44′ E.

As will appear from the above named localities, this Schizopod would appear, on the whole, to be a true deep-sea form, ranging, as it does, from a depth of 1000 to 1975 fathoms. It is worthy of remark, however, that the specimen described by Dana was taken from the stomach of a penguin; and, as it cannot be reasonably assumed that any air-breathing animal can descend to the enormous depths stated above, the said form may also be considered as occasionally occurring at a less considerable depth. It would seem, too, that this view is in part corroborated by the statement of the late Dr. v. Willemoes-Suhm, who says that in the Atlantic this species is met with at depths ranging from 350 to 2500 fathoms.

Distribution.—The late Dr. v. Willemoes-Suhm observes concerning this form that "it is the commonest Schizopod of the deep-sea fauna, and seems to enjoy a very wide bathymetrical and geographical distribution." Indeed its geographical range, as may be seen by comparing the above stated localities, is quite astounding, for it is met with not only throughout the great depths of the Atlantic, but also in the Antarctic Ocean, the Australian Seas, and even in the Pacific, as far north as Japan. No less perplexing, too, would appear the bathymetrical range of the species, descending, as it does, according to the statement of Dr. v. Willemoes-Suhm, to the enormous depth of 2500 fathoms, while, on the other hand, the fact of its forming occasionally the food of penguins would seem to give evidence of its occurrence, in the Antarctic Ocean, at a not very considerable depth below the surface of the sea.

Family 3. Euphausiidæ.

A very considerable number of forms belonging to this interesting family was collected by the Expedition. As most of the species lead a truly pelagic existence, the very

extensive use of the surface-net on the Expedition proved highly successful. In regard to the capture of Euphausidians this may pre-eminently be said to be the case, scarcely a single haul failing to yield some of the forms comprised in this group, either adult or larval. I have carefully gone over a vast number of surface gatherings, kindly sent me by Dr. John Murray, and from these have selected every form that belongs to the Euphausiidæ. A large proportion of the specimens thus brought together represent various stages of development; and it has therefore been a matter of no slight difficulty to determine in each case with full certainty whether the specimens should be regarded as adults, or whether merely as younger animals. I have been equally perplexed in attempting to refer the larval forms accurately to the several species. Meanwhile, a careful study of numerous specimens has finally enabled me to trace the development of at least three different forms belonging to as many genera, and I shall give a detailed account of these researches when treating of the development of the Euphausiidæ.

The total number of species represented in the collection amounts to no less than twenty-seven, comprising seven distinct genera, of which four are new.

I give below a synopsis of the genera, worked out from the structure of the legs.

Legs	nearly uniform in structure, and similar in appearance to the maxillipeds.	Both the two posterior pairs quite rudimentary,		*Euphausia*, Dana.
		Last pair only rudimentary; penultimate pair	of same appearance as preceding,	*Thysanopoda*, M.-Edw.
			with outer joints of stem confluent,	*Nyctiphanes*, G. O. Sars.
		All the legs distinctly developed,		*Bentheuphausia*, n. gen.
	somewhat unequally developed, one of the anterior pairs being greatly elongate.	First pair of legs greatly produced and	rather strong, the two last joints armed with spiniform bristles on both margins,	*Thysanoëssa*, Brandt.
			very slender, filiform, naked, with only a tuft of apical bristles,	*Nematoscelis*, G. O. Sars.
		Second pair of legs greatly produced; penultimate joint dilated, and forming, together with the last one, a kind of prehensile hand,		*Stylocheiron*, G. O. Sars.

Genus 1. *Euphausia*, Dana, 1852.

Euphausia, Dana, United States Exploring Expedition, vol. xiii., Crustacea, part i. p. 639.

Generic Characters.—Carapace with antero-lateral angles but slightly produced, rostral projection, as a rule, small. Tail powerfully developed. Eyes of normal structure. Antennular peduncle alike in both sexes, cylindrical, basal joint sometimes provided at the end superiorly, with a small lappet; both flagella elongate, and consisting of numerous joints.

Second pair of maxillæ with terminal joint very broad, exognath comparatively small. First pair of legs nearly similar in structure to maxillipeds and succeeding legs, save that the terminal joint is somewhat expanded and armed with a fascicle of short spines. The two last pairs of legs quite rudimentary, being present only as minute, setiferous processes. The four anterior pairs of gills forming single, curved stems, fringed with a row of narrow gill-sacs; the three posterior pairs much more complex, sending off a branch interiorly; exterior branch in last pair to a greater or less degree abundantly arborescent. The usual number of luminous globules present.

Remarks.—This genus was established by Dana, who distinguished it from the genus *Thysanopoda*, M.-Edw., chiefly by the rudimentary character of the two posterior pairs of legs. This, indeed, would seem to be one of the most striking features by which the present genus may be distinguished from other genera of Euphausiidæ. Moreover, the structure of the gills is somewhat different from that in other forms of this family.

The genus at present comprises no less than eleven different species, all of which are represented in the Challenger collection. Of these, four only have been previously recorded, the other seven being new. The Arctic species established by Kröyer under the names of *Thysanopoda inermis*, *Thysanopoda neglecta*, and *Thysanopoda longicaudata*, which I previously referred to the present genus, ought to be comprised within a distinct genus, *Boreophausia*, G. O. Sars, not represented in the Challenger collection.

Since the genus *Euphausia* may be regarded as the type of the family, I have deemed it advisable, before passing on to the special description of the species, to give a general account of its organisation, as gathered from a careful dissection of several specimens belonging to one of the species, *Euphausia pellucida*, Dana.

General Description of the Genus.—The form of the body (see Pl. XI. figs. 1, 2; Pls. XIII.–XVI.) is generally rather slender, and somewhat compressed, with the tail powerfully developed and always much longer than, sometimes even exceeding twice the length of, the anterior division.

All the integuments are very thin and translucent, admitting of the muscles of the body, and also certain of the viscera, being more or less distinctly traceable through them.

The carapace, as in other Euphausiidæ, is comparatively small, leaving the bases of the legs, with their gills, bare, and posteriorly it does not completely cover the last segment of the trunk, a portion of which always appears exposed above. Differing from all other families of Schizopoda, it is, moreover, connate with the trunk along the whole of the median line, in such a manner that none of the segments, excepting the last, appear completely defined dorsally. Regarding its structure, it is very thin and pellucid, without any kind of sculpture, save a slight transverse depression on its anterior part, representing the cervical sulcus. Posteriorly it exhibits in the middle a conspicuous emargination, encompassing the exposed dorsal part of the last segment of the trunk. The lateral wings of the carapace are evenly rounded, and project a little over the sides

of the first caudal segment, being also partially overlapped by a lamellar projection extending anteriorly from this segment. The anterior part of the carapace is generally slightly keeled above, and projects into a more or less marked rostral process. The antero-lateral corners of the carapace are very slightly produced, exhibiting at the sides of the basal part of the antennæ a small dentiform projection, apparently corresponding to the antennal spine in other Podophthalmia.

The five anterior caudal segments are provided with distinctly developed lamellar epimera, projecting beyond the ventral face and pointing obliquely backwards. The last segment is much narrower than the preceding ones, and rather compressed, without any trace of epimera, but usually armed beneath its end with a compressed tooth, placed immediately anterior to the anal opening (preanal spine).

The eyes are well developed, and generally of a pyriform shape, having the pedicle composed of two segments, and the cornea expanded, globular, with a very dark pigment, and distinctly developed visual elements. Moreover, they invariably contain within the pedicle posteriorly and somewhat inferiorly a peculiar, highly luminous, organ (Pl. XI. figs. 7, *b*, 8), more fully described in the sequel. Between the bases of the eyes, too, may be observed a small but distinct spot of black pigment (the larval eye), apparently containing anteriorly a minute refracting body (see Pl. XI. fig. 7, *a*).

The antennular peduncle (see Pl. XII. figs. 1, 2) is rather elongate, always projecting far beyond the antennal scale, and cylindrical in form, with its three joints gradually diminishing in size. The structure is precisely the same in both sexes. The basal joint is somewhat flattened in its proximal part, and in some species exhibits at the end, above, a small membranous lappet. Moreover, it is furnished with several finely ciliated bristles, of which a dense fascicle is seen issuing from the outer corner. The last joint exhibits a longitudinal keel, and exteriorly, at the end, a small lobe, from the base of which issue two densely ciliated bristles. Both the flagella are rather elongate, though far from attaining the length of the body, and consist of numerous small articulations. The outer flagellum has at the base a slight intumescence, beset with a fascicle of translucent sensory bristles.

The basal part of the antennæ (see Pl. XII. figs. 5, 6) is rather large, and divided into two indistinctly defined segments, of which the proximal exhibits on the ventral face a small opening, surrounded by a somewhat tubular projecting border, the outlet of the so-called "green gland." The distal segment juts forth at the end exteriorly beneath the scale, as a more or less elongate spine. The terminal part of the antenna consists of a rather elongate three-jointed peduncle and a slender multi-articulate flagellum, somewhat longer than the flagella on the antennulæ. The scale is more or less elongate-ovate in form, having the outer edge straight and naked, terminating also in a very small dentiform projection, sometimes, however, obsolete. The apex is truncated, and, like the inner edge, fringed with a dense row

of ciliated setæ. No trace of any apical articulation occurs either in this or in other genera of Euphausiidæ.

The anterior lip (see Pl. XI. fig. 6, *l*; Pl. XII. fig. 7) forms a triangular fleshy prominence, placed between the basal parts of the antennæ, and to some extent concealing the inner ends of the mandibles. It projects anteriorly into a sharp point, and exhibits, on the lower face, a thin transverse membrane, doubling over the body from behind, and deeply incised in the middle.

The posterior lip (Pl. XII. fig. 8) is formed of two membranous lobes, of triangular form, separated by a deep incision almost to the base. The inner edges of these lobes are finely ciliated throughout.

The mandibles (see Pl. XI. fig. 6, *m*; Pl. XII. fig. 9) have a rather strong, curved body, with the masticatory part securiform-expanded. The cutting edge is armed with strong, dentiform projections, somewhat different in shape on the two mandibles, and in recent specimens of a vivid reddish-brown colour. The molar prominence is well defined, and has a rather extensive fluted surface. The palp (Pl. XII. fig. 11; Pl. XIII. fig. 10; Pl. XV. figs. 5, 15) scarcely exceeds the body of the mandible in length, and presents a somewhat deviating form in the different species. It consists, as usual, of three joints, of which the median is the largest, and is furnished with a moderate number of ciliated bristles, those on the last joint sometimes assuming the character of spines.

The first pair of maxillæ (Pl. XII. fig. 12; Pl. XIII. fig. 11; Pl. XV. figs. 6, 16) exhibit a somewhat different form from that observed in the other families of Schizopoda, being furnished with both a well developed palp and an exognath. The basal part is divided into two imperfectly defined segments, both of which project inward as well marked masticatory lobes. Of these lobes, the outer one is by far the stronger, and abruptly truncate at the end, which is furnished with a row of strong spines as well as a series of delicate bristles. The inner or basal lobe is more decidedly membranous in consistence, and somewhat linguiform, fringed along the anterior margin and at the rounded tip with a row of strong setæ, diminishing in length outwards. The palp, issuing from the distal segment of the basal part, and directed forward, consists of a single lamelliform joint, beset along the inner edge and tip with a double row of strong, ciliated bristles. Finally, the exognath forms a rather large but very thin and pellucid plate of an oval, or rather elliptical form, affixed to the outer side of the proximal segment of the basal part, and fringed at the rounded anterior end with a few short bristles.

The second pair of maxillæ (Pl. XII. fig. 13; Pl. XIII. fig. 12; Pl. XV. figs. 7, 17) also differ considerably in their general appearance from what is observed in other Schizopods. Both of the masticatory lobes are very short and broad, and proceed directly inward at right angles. They are slightly cleft in the middle, forming together four densely setiferous lobes. The palp, as in the first pair, consists of only a single rather large, lamelliform, joint, issuing from the end of the basal part and beset with bristles,

more especially along the inner edge. The exognath, too, is very small, forming simply a slight lamellar expansion of the outer edge of the basal part, and fringed with a row of short, densely ciliated, bristles. The proximal portion of the basal part forms a thick muscular segment, with the outer edge somewhat curved, and in some species furnished with a few bristles of a similar appearance to those affixed on the exognath.

The maxillipeds (Pl. XII. fig. 14) are quite pediform in structure, and only to a very slight extent differ from the succeeding true legs; hence they have generally been described by earlier authors as the first pair of legs. They consist of seven distinctly defined joints, of which the two proximal correspond to the basal part of the maxillæ, whilst the others represent the palp. The first, or coxal, joint projects inwards into a linguiform setose lobe (masticatory lobe), and in addition to this bears on its external surface a very small, simple epipodite, corresponding, as regards location, to the gills on the true legs. The second, or basal, joint is rather broad and compressed, exhibiting, on the outer side, a distinctly developed natatory branch (exopodite) of precisely the same appearance as the exopods on the legs. The ischial joint is somewhat broad, but gradually tapers towards the apex. The meral joint is much more elongate and slender, and forms, in conjunction with the carpal joint, a rather mobile articulation, the outer part of the maxilliped being generally, as in the legs, recurved almost at right angles to the remaining part. The propodal joint is somewhat larger than the carpal, without, however, attaining to anything like the length of the meral joint, and exhibits a linear form, precisely as in these joints. The terminal joint, finally, does not differ essentially from the preceding joints, save that it is a trifle shorter; it has, too, a row of short simple bristles (see fig. 15) along its inner edge, besides two or three longer ones. All the preceding joints are fringed along the inner edge, with a double series of delicate bristles, those of the inner row being very long and beset on both edges with small and somewhat widely placed hairs. On the ischial and basal joints these bristles become shorter and more numerous, assuming an almost spiniform character.

The first pair of legs (fig. 16) exhibit a very similar structure to that of the maxillipeds. They are, however, a little longer, and have the terminal joint (fig. 17) somewhat dilated and compressed. Each leg is also furnished at the inner edge with a row of peculiar curved spines, densely crowded together, as well as a series of short ciliated bristles. The inner lobe of the coxal joint is much swollen, and contains within a well developed luminous globule. The epipod, too, has assumed the character of a true gill. The exopod in this and the succeeding pair consists, as does the exopodite of the maxillipeds, of a muscular basal portion, and a lanceolate, compressed terminal part, fringed with strong natatory setæ; the articulation between the two parts is very oblique, the basal portion jutting out exteriorly at an acute angle.

The second pair of legs (fig. 18) are a trifle longer than the first pair, and only differ

from these, in the coxal joint wanting the luminous globule, and in the terminal joint being simply linear, and furnished with similar bristles to those on the preceding joints.

The three succeeding pairs of legs successively diminish in length, but exhibit otherwise precisely the same structure as the second pair. The last of these pairs, or the fifth in the series (fig. 19), has the joints somewhat more slender, and generally so bent that the terminal part, when the legs are extended, curves in an opposite direction. The gills attached to these legs are much more complex in structure than is the case with those on the preceding pairs.

Of the two last pairs of legs no trace can be detected exteriorly. Only on dissecting the animal and separating the two posterior pairs of gills (see Pl. XI. figs. 9, 11) does a minute non-articulate stem, apparently the rudiment of the leg, become perceptible, affixed to the inner side of each gill. This stem (fig. 12) is provided with a few simple bristles, and would seem to represent the endopod rather than the exopod.

The gills (see Pl. XI. fig. 5) are true "podobranchiæ," being attached to the outer side of the coxal joints of the legs, and thus, apparently, representing the modified epipods. There are seven pairs, wholly uncovered, as stated above, by the carapace, projecting at some distance beneath its inferior margin, and arranged in a dense series along each side of the trunk, partly overlapping each other posteriorly. They continue increasing in size posteriorly, and the last pair are very much larger than any of the others, and partly project along the sides of the first caudal segment. As to their structure, the four anterior pairs (see Pl. XII. figs. 16, 18, 20, 21) are much simpler than the three posterior, consisting merely of an inferiorly and anteriorly curving stem, from which issues posteriorly a regular series of slender, digitiform, or filiform appendages, diminishing gradually in length towards the apex, which appears more or less curled up. These appendages, representing the true gill elements, exhibit internally, in spirit specimens, a fairly regular double series of small globular corpuscles (fig. 22), which, apparently, are blood-cells, arranged according to the centrifugal and centripetal course they take through the appendages during life. The fifth and sixth pairs of gills (Pl. XI. fig. 9; Pl. XII. fig. 19) are divided into three branches, the two outer of which exhibit precisely the same structure as each of the anterior gills, while the inner branch is distinctly bipinnate or furnished with a double row of gill appendages. This branch, too, being the largest, is, as in the Lophogastridæ, bent in beneath the trunk, meeting the corresponding branch on the opposite side in the median line. Finally, the last pair of gills (Pl. XI. fig. 11) is far more complex in structure than any of the others, the outer branch being very large, and more or less richly arborescent; or it may send off numerous secondary branches, each of which presents a similar structure to that of the anterior gills.

In what manner the ova, immediately after being discharged from the ovaries, are carried by the females of this genus, I am unable to state, none of the specimens examined having been furnished with external egg-bags.

The caudal limbs (Pl. XII. fig. 24) are powerfully developed in both sexes, and represent true swimming organs. The basal part is somewhat adpressed and very muscular. The terminal branches are shorter than the basal part, and exhibit the form of lanceolate plates, fringed with strong natatory setæ. The inner plate (Pl. XII. fig. 25) is rather smaller than the outer, and exhibits, as in most Caridea, a slender secondary lobe attached to the inner edge, and having at the tip a number of small curled spines (cincinnulæ). In the male, this branch on the two anterior pairs is peculiarly modified, to serve as a copulatory organ (see Pl. XI. fig. 4). Especially on the first pair, this plate (Pl. XII. fig. 28; Pl. XIII. figs. 3, 13; Pl. XIV. fig. 7; Pl. XV. fig. 22; Pl. XVI. figs. 6, 14, 20) presents a very complex structure, consisting of two principal portions, the outer lamellar, and setiferous at the tip, and exhibiting on the posterior face a rounded projecting lobe, doubled over the plate; whereas the inner juts out into several strongly chitinised processes of different forms, some assuming the shape of strong hooks or pincers. This portion, too, is generally folded over the other in such a manner as to render it a matter of some difficulty to spread out the whole plate in the same plane, with a view of obtaining a correct idea of its structure. Of the two portions described above, the outer only is found to correspond with the female plate, having likewise affixed to it the secondary lobe mentioned above, whereas the inner portion is quite peculiar to the male, since it constitutes another enormously developed lobe, extending above the former from the inner edge of the principal plate. Also on the second pair of caudal limbs, the inner plate in the male (see Pl. XII. fig. 29; Pl. XIII. figs. 4, 14; Pl. XIV. fig. 8; Pl. XV. figs. 2, 3; Pl. XVI. figs. 7, 15, 21) exhibits a somewhat diverging appearance; but here it would seem that the secondary lobe itself, which is common to both sexes, becomes peculiarly modified, since it juts out at the apex into several twisted lobules, generally reaching more or less beyond the tip of the principal plate; the cincinnulæ occur on a slight rounded prominence at the outer side of the lobe. As to the function of these remarkable appendages in the male, there can, I think, be little doubt of their serving to seize the spermatophores and place them on the sexual openings of the female. The first pair are unquestionably most effective for this purpose, whilst the second pair perhaps perform merely a coadjutory function.

The telson (Pl. XII. fig. 27) in all the species of this genus, as well as in the other known Euphausiidæ, exhibits a very similar appearance, being exceedingly slender and tapering to an acute point. On the upper face two pairs of small denticles generally occur, and on the lower face, at some distance from the apex, two very large spiniform appendices are affixed in close proximity, slightly diverging and generally reaching far beyond the tip of the telson. At the base of the telson, and likewise on the lower side, is seen the anal opening, in the form of a longitudinal fissure.

The uropoda (*ibid.*), too, only exhibit slight structural differences in the several forms of the Euphausiidæ. The basal part is rather short and thick, jutting out

externally as a small dentiform projection, and fringed at the outer edge with a row of ciliated bristles. Both terminal plates are very slender, the outer, however, being somewhat broader than the inner, and of an oblong-linear form, with the outer edge naked and straight, and terminating as a very small dentiform process, the apex narrowly truncate, and, in common with the whole of the inner edge, having a row of long, ciliated bristles. The inner plate is exceedingly narrow, conically tapered, and fringed throughout with similar bristles. The length of the plates with respect to each other, as also to the telson, varies somewhat in the different species, thus affording a comparatively good specific criterion.

Luminous Globules.—These peculiar organs, for which I would suggest the above designation, have not escaped the observation of earlier zoologists, and in part have even been closely examined and described, most accurately by Professor Claus.[1] In living examples they are very conspicuous, and also in spirit-preserved specimens they admit of being readily detected on dissection. The view generally favoured regarding the function of these organs is, as is well known, that in some way they are subservient to sight, whence they have been named by most authors "accessory eyes." I have carefully examined these organs both in spirit specimens and in the living animal, and have been led to form a very different opinion, conceiving them to have nothing whatever to do with sight, but merely representing highly differentiated luminous organs. The reasons on which I base such an assumption will be set forth in the sequel. I shall first describe the organs under consideration as they occur in the genus *Euphausia*.

In all the species of this genus, as also in most other Euphausiidæ, they appear as small globules, very conspicuous in the living animal by reason of their beautiful red pigment and glistening lustre, and are symmetrically arranged both on the anterior and the posterior divisions of the body. On the trunk are observed (see Pl. XI. figs. 1, 2) two pairs of such globules, the one situated within the coxal joint of the first pair of legs (see Pl. XII. fig. 16), the other within a corresponding dilatation issuing from the base of the penultimate pair of gills (see Pl. XI. fig. 9). On the tail they occur along the ventral face, in the median line, between the bases of the pleopoda, each of the four anterior segments having a single globule. In addition to the above mentioned globules may be observed, as stated above, within the pedicle of the eyes, an organ of somewhat similar appearance, though less completely developed (see figs. 7, 8). With the exception of this last organ, all the others would seem to exhibit precisely the same structure. Those most easy to examine without dissection are the hindmost pair on the trunk (Pl. XI. fig. 10), as they lie in a position altogether external, immediately beneath the inferior margin of the carapace. On placing the living animal under the microscope, and applying a slight pressure by means of a cover-glass, in order to arrest its movements, these organs admit of being examined through a comparatively powerful

[1] Ueber einige Schizopoden und niedere Malacostraken Messina's, *Zeitschr. f. wiss. Zool.*, Bd. xiii. pp. 446, 447, 1863.

magnifier, without any further preparation. In spirit specimens, somewhat greater difficulty attends the research, since the transparency of the integuments, as also that of the organ itself, is considerably diminished by the action of the alcohol.

The organs, when isolated (see Pl. XII. fig. 26), are found to consist of perfectly globular bodies, with a very complicated structure, bearing, in some particulars, great resemblance to that of the eyes in vertebrates. A rather thick and elastic cuticle forms the outer envelope of the organ, which, moreover, in fresh specimens is coated with a beautiful red pigment in its posterior half, whereas the front portion remains quite pellucid. On closer examination, these two portions are found to fit as it were into each other, without being actually connate, and on dissecting alcoholic specimens, the two hemispheres will even readily separate from each other. At the junction, a glistening ring may be seen internally, encompassing in the middle a highly refractive lenticular corpuscle. The posterior hemisphere is filled up with cellular matter, in the midst of which lies embedded a flabelliform bunch of exceedingly delicate fibres, exhibiting in fresh specimens a most beautiful iridescent lustre. To the equatorial zone of the organ, moreover, two or three thin muscles are attached, admitting, to a certain extent, of its being rolled to and fro.

The above described parts are, it is true, of such a nature as might readily lead one to assume that these organs are highly developed eyes. The lenticular corpuscle in particular presents, both as regards its structure and its position, a striking resemblance to a true eye-lens. The glistening ring too that surrounds it might easily be taken for a kind of iris. The diaphanous front of the organ likewise and the red pigment coating of the hinder part, as also the arrangement of the muscles for moving the whole organ, would seem to favour such an assumption.

Notwithstanding this great resemblance to visual organs, researches conducted with the living animal have convinced me that none of these organs are coadjutory to sight, but that they all together constitute a very complicated and peculiarly developed luminous or phosphorescent apparatus.

It has already been stated by W. Thompson that these Crustacea are highly luminous at night, and for this reason he suggested for them the generic name "*Noctiluca*." I myself have several times had opportunities of testing the accuracy of this statement as regards the Norwegian species of the family, and have convinced myself that the animal is able, by varying the movements of the organs, to increase or diminish the light at will. The chief light-producing matter I have found to be the fibrous fascicle lying in the centre of the globular corpuscle. Even if the organ be crushed, and this fascicle extracted, it still continues to give forth a comparatively strong phosphorescent light when seen in the dark. The lenticular corpuscle placed just in front of this fibrous matter may, I conceive, act as a condenser, producing a bright flash of light, the direction of which admits of being changed at the will of the animal, by simply rolling the organ by means of its muscular apparatus. The pigment-coating of the hinder portion, and

the diaphanous condition of the front part, may likewise be easily explained as subservient to such a function.

That the organs in question cannot, as formerly held, be eyes, may be inferred from several facts:—1. The nerve that penetrates the organs, or at least those belonging to the trunk, is very thin, and does not give rise to any special (retinal) expansion. 2. The structure of the hinder part of the globule is wholly different from that observed in true eyes, being completely filled with a cellular mass, in the centre of which the fibrous corpuscle lies embedded, and having its pigment-coating not internal but external. 3. The arrangement of the organs belonging to the tail is such, assuming the organs to be eyes, as by no means to admit of a good visual impression, the constant motion of the pleopoda approximating the organs at very short intervals, whereas the effect of phosphorescence may for that very reason be materially augmented, giving to the light a glittering or tremulous lustre. 4. Finally, I have found, as stated above, a similar organ embedded in the pedicle of the true eyes themselves, and this organ, being immobile, also entirely lacks the front hemisphere with its lenticular corpuscle, whereas the hinder one in every respect agrees with the posterior part of the other organs, exhibiting in the centre a large bunch of phosphorescent fibres, and externally a coating of red pigment (see Pl. XI. fig. 8). It is certainly far from probable that any one examining the last of these organs would venture to assign it the function of sight; and, indeed, Professor Claus, who has recorded and figured the organ in the larvæ—in the adult animal it would seem to have totally escaped his attention—has nothing whatever to state respecting its probable function. Meanwhile, the organ undoubtedly bears the closest relation to the above described globules, both in regard to structure and function, the light it produces being, in fact, very intense, though comparatively more steady, than is that from the other movable organs. Since the eye-pedicles, however, are themselves movable, the animal may also, to a certain extent, be able to vary the effect of these organs.[1]

Nervous System (see Pl. XII. fig. 30).—The nervous cord in the Euphausiidæ exhibits certain rather striking peculiarities as compared with that in other Schizopods. Thus, the number of separate ganglia belonging to the anterior division of the body is greater than in any other known form of podophthalmous Crustaceans, since, exclusive of the cerebral or supra-œsophageal ganglion, no less than eleven ganglia occur, all of which, however, lie embedded, as it were, within a common envelope of connective tissue. The most anterior only of these ganglia, belonging apparently to the mandibular segment, would seem to present all the features of a simple nervous dilatation, whereas the succeeding ones consist of two well-marked lateral halves, and are connected by double and somewhat distant commissures. Each of the two pairs of maxillæ are innervated by their separate ganglion, whereas these ganglia in most other Crustacea are, as is well-known, united and consolidated with the mandibular ganglion into one nervous mass. The two posterior ganglia

[1] See Narr. Chall. Exp., vol. i. p. 743, 1885.

of the trunk lie close together, at a considerable distance from the preceding ganglia, the commissures being rather long, and also less distant, than are those connecting the preceding ganglia.

The supra-œsophageal or cerebral ganglion is rather large, and exhibits a somewhat elliptical form, its transverse diameter being the larger. On its upper surface, close to the anterior margin, is seen embedded the ocellus, or larval eye; and from each side proceed the greatly developed optic nerves, forming in the interior of the eye-pedicles a large ganglionic tumescence, within which lies immersed the previously mentioned luminous organ. Moreover, from the inferior face of the ganglion originate two pairs of strong nervous trunks, each of which exhibits at the base a conspicuous ganglionic swelling; the one pair passes anteriorly in a direct line to the antennulæ, the other curves out exteriorly, entering the basal portion of the antennæ. The commissures connecting the cerebral ganglion with the first ventral are exceedingly long and at a wide distance apart, encompassing the œsophagus, and are connected together immediately behind it by a thin transverse commissure; each, too, sends off before its union with the mandibular ganglion a slender nerve, which passes apparently to the stomach.

The caudal ganglia are by comparison exceedingly large, slightly exceeding even those of the trunk, and are connected by very long commissures lying close together. As is the case in *Gnathophausia*, and perhaps in most of the Podophthalmia, a pair of slender nerves, exclusive of the strong nerve-trunks originating from the ganglia themselves, extend from the commissures, apparently innervating the musculature of the tail. Furthermore, from the last caudal ganglion originate numerous nerves, most of which enter the caudal fan, innervating its various parts.

Digestive System (see Pl. XI. fig. 5).—The œsophagus is very short, ascending perpendicularly to the stomach. Its walls would seem to be strongly chitinised, and are continued into the inner (upper) coating of the anterior and posterior lips. The stomach (*st*) lying, as usual, within the most anterior part of the visceral cavity in front of the cervical groove, exhibits on the whole a similar structure to that in the Mysidæ, being armed, more particularly at the ventral face, with numerous chitinous ridges, beset with delicate bristles. Several strong muscles are attached to the stomach, by means of which its several parts admit of being moved one against the other, thus crushing or bruising the food before it is forced into the intestine. The pyloric section of the stomach has above two small, incurving cæca, and to its inferiorly protruding part is appended the liver (*l*), in the form of two rather large ovoid masses, which are partly united, and consist of a prodigious number of minute cæca, crowded together. The intestine (*i*) has the form of an exceedingly narrow tube passing through the posterior part of the trunk and the whole of the tail, and terminating in a short rectum that opens at the base of the telson through a longitudinal fissure. In the living animal the whole

intestine exhibits very energetic and uninterrupted peristaltic and antiperistaltic movements, giving it a peculiar moniliform aspect.

Circulatory System.—The heart (Pl. XI. figs. 5, 6, *h*) is placed immediately beneath the posterior part of the carapace, and exhibits a structure very similar to that observed in the higher Podophthalmia, being rather concentrated, of a somewhat short polygonal form, and furnished with six pairs of fissiform venous openings, for the entrance of the blood accumulated in the pericardial sinus. Moreover, the number and arrangement of the principal arterial trunks would seem to agree perfectly with that observed in higher Crustaceans.

Generative System.—The ovaria (Pl. XI. fig. 5, *ov*) form two partly connate masses of a somewhat irregular ovoid form, placed beneath the heart, and projecting anteriorly to a greater or less extent above the liver. They are found to contain numerous, perfectly translucent egg-cells which vary in size, and from their lower face give origin to two rather strong oviducts, extending straight downwards and opening close together on the sternal part of the antepenultimate segment of the trunk. Here, too, may often be seen affixed two pedunculated vesicles, the spermatophores (Pl. XIII. fig. 7).

The testes are combined as a comparatively small bunch of rounded, anteriorly pointing cæca, lying in front of the heart, immediately beneath the carapace. The vasa deferentia are very long and flexuouse, extending posteriorly into the last segment of the trunk, where they curve abruptly downward, and form a considerable dilatation (see Pl. XI. fig. 4), within which may be observed the developing spermatophore. The latter exhibits in the present genus (see Pl. XII. fig. 23) a somewhat lageniform appearance, being gradually dilated toward the apex, and possessing a highly chitinised envelop. The spermatozoids constitute simple, elliptical, nucleate cells.

Habitat and Distribution.—All the known species of this genus are truly pelagic, the animals being often found in great profusion swarming at the surface of the sea, especially at night; but in all probability they descend at times to considerable depths, as is alleged to be the case with most other pelagic animals.

The genus would seem to be distributed throughout most parts of the ocean, except perhaps the Arctic region, where it is represented by a closely allied generic type, *Boreophausia*, G. O. Sars.

The following synopsis of the species may be here appended :—

- Frontal part of carapace
  - acutely produced. Eyes
    - rather large, pyriform. Inferior margin of carapace armed with
      - two denticles, . *E. pellucida*, Dana.
      - a single denticle, *E. similis*, G. O. Sars.
    - very small. Third caudal segment
      - smooth, not produced, . . *E. gracilis*, Dana.
      - produced to an acute posteriorly curving lappet, . . *E. gibba*, G. O. Sars.
  - very slightly produced. Inferior margin of carapace
    - smooth, ... *E. superba*, Dana.
    - armed with a single denticle placed
      - anteriorly to the middle, . *E. murrayi*, G. O. Sars.
      - in the middle. Third caudal segment
        - smooth, . . *E. splendens*, Dana.
        - produced to a posteriorly pointing spine, . *E. mucronata*, G. O. Sars.
  - produced to a strong rostral projection, and armed with distinct supra-orbital spines. Caudal segments partly spinous, . . *E. spinifera*, G. O. Sars.
  - projecting as a broad plate
    - triangularly pointed, ... *E. antarctica*, G. O. Sars.
    - truncate at the apex, ... *E. latifrons*, G. O. Sars.

14. *Euphausia pellucida*, Dana (Pls. XI., XII.).

Euphausia pellucida, Dana, United States Expl. Exped., vol. xiii., Crustacea, p. 641, pl. xlii. fig. 4, *a–m*.

Euphausia mülleri, Claus, Zeitschr. f. wiss. Zool., Bd. xiii. p. 432, pl. xxviii. figs. 29–31, pl. xxix.

Thysanopoda bidentata, G. O. Sars, Oversigt af Norges Crustaceer, Bd. i. p. 50, pl. i. figs. 11–14.

Euphausia pellucida, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 13.

Specific Characters.—Carapace with two lateral denticles on either side, frontal part produced and acutely pointed. Caudal segments smooth, epimera rather large and of uniform appearance. Last segment longer than the preceding; preanal spine tridentate. Eyes of moderate size, pyriform. Basal joint of antennulæ with an erect leaflet above, usually divided into two acuminate lappets. Antennal scale oblong-ovate, obtusely truncate at apex, outer corner unarmed; basal spine very large, and denticulate at inner edge. Terminal joint of second pair of maxillæ short and broad, with a row of small teeth anteriorly. Telson elongate; subapical spines very large, and finely denticulate at inner edge. Inner plate of uropoda longer than outer. Usual length of adult female 10 to 15 mm.

Remarks.—This would seem to be by far the commonest of all the Challenger species

of *Euphausia*, and, as it cannot reasonably be supposed to have escaped the attention of Dana, I have deemed it advisable to refer the animal to one of the four species described by that author. Of these, the species *Euphausia pellucida* is the one that would seem to agree best with the present form, for which, accordingly, I propose to retain the specific appellation first suggested by Dana. That the *Euphausia mülleri* of Claus is identical with the form here treated of is undeniable, and the form described by myself as *Thysanopoda bidentata* unquestionably also belongs to the same species.

Description.—The usual length of the adult female is 10 to 15 mm., that of the male somewhat less; but there are a few specimens in the collection that reach a length of 17 mm.

The form of the body (see Pl. XI. figs. 1, 2, 4) is rather slender, and, as usual, somewhat compressed throughout, with the tail about twice the length of the anterior division.

The carapace has the anterior part distinctly keeled above, and jutting forth as a sharp-pointed rostral projection, reaching to about the middle of the basal joint of the antennulæ. Posteriorly it exhibits an almost rectangular emargination, the lateral angles of which are produced into narrow sinuses, marking sharply off above the lateral wings of the carapace, which are broadly rounded (see also figs. 5, 6). Immediately superior to the lower margins on either side occur two small anteriorly pointing denticles, the posterior of which is placed above the point of insertion of the fourth pair of legs, the anterior above that of the maxillipeds. The antero-lateral corners of the carapace constitute at the side of the basal part of the antennæ a very slight dentiform projection, apparently corresponding to the antennal spine in other Podophthalmia.

The caudal segments are powerfully developed, and quite smooth above, diminishing somewhat both in height and breadth posteriorly. The epimera are rather large and laminar, projecting considerably beyond the ventral face, and covering at the sides the bases of the pleopoda. They all exhibit a comparatively uniform appearance, being somewhat angular in shape, and pointing obliquely backward. The last segment is a trifle more elongate than any of the preceding, and much narrower, without any trace of epimera, but armed at the end, beneath, with a compressed, tridentate, pectiniform spine (fig. 3), placed immediately in front of the anal orifice.

The eyes (fig. 7) are of moderate size, and pyriform, with the cornea rather expanded, and projecting on either side (see fig. 2).

The antennular peduncle (Pl. XII. figs. 1, 2) is about half as long as the carapace, and nearly cylindrical in form; it is more particularly distinguished by the basal joint, having at the end above a conspicuous erect leaflet or membranous lobe. In most of the specimens this lobe is divided into two acuminate lappets (fig. 3); but in some specimens, though differing in no other respect from the typical form, these lappets are much more numerous, forming a dense fringe along the free edge of the leaflet (fig. 4).

The antennal scale (fig. 5), but very slightly projecting beyond the second joint of the antennular peduncle, exhibits an oblong-ovate form, its greatest breadth equalling about one-third of the length. The apex is abruptly truncate, with the outer corner unarmed and well-nigh forming a right angle. The basal spine, projecting beneath the scale, is very strong, and extends far beyond half its length; it is armed at the inner edge with a row of fine denticles. The basal part of the flagellum reaches to the apex of the scale, and is rather strong, with the two outer joints uniform in size.

The mandibular palp (see figs. 9, 11) scarcely attains the length of the mandible itself, and is specially distinguished by the middle joint being furnished (exclusive of the usual marginal setæ) with numerous short, spiniform bristles, arranged partly in a double series along the inner side.

The first pair of maxillæ (fig. 12) have the exognath comparatively small, and of an oval form.

The second pair of maxillæ (fig. 13) are distinguished more particularly by the short and broad form of the terminal joint, which, moreover, exhibits anteriorly (apart from the usual setæ) a row of diminutive spiniform bristles similar to those on the mandibular palp.

The maxillipeds (figs. 14, 15), the legs (figs. 16–19; Pl. XI. fig. 12), and the gills (Pl. XII. figs. 19–22; Pl. XI. figs. 9, 11) exhibit the structure characteristic of the genus.

The copulatory appendages projecting from the inner plate of the two first pairs of pleopoda in the male (see Pl. XI. fig. 4) are very powerfully developed. Those on the anterior pair (Pl. XII. fig. 28) jut out into three strong processes, the two outer of which are highly chitinised, and bent in the form of hooks; one of them has the apex simple-acuminate, whereas the other expands at the tip into a serrate oblong plate. The appendages to the second pair of pleopoda (fig. 29) branch out into two soft, irregularly lobular processes, reaching far beyond the tip of the principal plate.

The telson (see fig. 27) is very slender and elongate, almost equalling in length the two posterior segments taken together, and has the apex produced to a lanceolate point. The subapical spines are strongly developed, reaching far beyond the tip of the telson, and diverging from each side; they are also finely denticulate along their inner edge. Moreover, on the upper face, anterior to the point of insertion of the subapical spines, occur two pairs of minute denticles, placed at some distance from each other.

The uropoda (*ibid.*) do not nearly attain the tip of the telson, and have the inner plate rather longer than the outer, but very much narrower.

Colour.—Dana states that this form, in a living state, is quite pellucid, without any conspicuous pigmentation; and hence he suggested the specific name "*pellucida.*" The solitary specimen also, taken by myself off the Norwegian coast, and at first described as *Thysanopoda bidentata,* exhibited a perfect transparency throughout the whole body.

Habitat.—All the specimens of this species collected on the Challenger Expedition were caught in the tow-net at the surface of the sea, in many different parts of the ocean. As regards the localities, the date alone was, in most cases, recorded on the labels, the tow-net having been on many occasions resorted to when neither dredging nor trawling was carried on. Hence, the localities for this and other species of Euphausiidæ cannot in every case be referred to any of the actual Station numbers. To faciliate this question, I have made an attempt in the following list to specify the tracts of the ocean where the specimens were caught, by comparing the dates recorded with the Stations marked off on the map accompanying the list of Observing Stations prepared for the use of the naturalists engaged in furnishing an account of the voyage.

Date.	Locality.
June 18, 19, 1873.	North Atlantic, between the Azores and Bermuda.
August 16, 1873.	Tropical Atlantic, off African coast.
October 5, 1873.	South Atlantic, south-east of Rio de Janeiro.
December 19, 1873.	South of Cape of Good Hope.
August 11, 12, 1874.	Pacific, off Kandavu, Fiji Islands.
August 25, 26, 1874.	West Pacific, Api to Cape York.
(No date recorded.)	Australian Sea, Sidney to Wellington.
February 6, 1875.	Celebes Sea, off Mindanao, Philippine Islands.
February 1875.	North of New Guinea.
March 13, 1875.	North of New Guinea.
April 3, 1875.	North Pacific, south of Japan.
June 23, 1875.	North Pacific, east of Japan.
July 4, 1875.	North Pacific, further east.
July 1875.	North Pacific, Japan to Honolulu.
August and September 1875.	Tropical Pacific, south of the Sandwich Islands.
August 24, 1875.	Tropical Pacific, south of the Sandwich Islands.
October 18, 1875.	South Pacific, about midway between New Zealand and Chili.
October 21, 1875.	South Pacific, about midway between New Zealand and Chili.
April 13, 1876.	Tropical Atlantic, off African coast.
April 26, 1876.	Tropical Atlantic, off St. Vincent, Cape Verde Islands.
April 28, 1876.	North Atlantic.

The specimens examined by Dana were collected in the Pacific, near Northern Kingsmill Islands.

Distribution.—As shown by the above stated localities, this species exhibits a truly astonishing geographical range, having been met with in almost every tract of the ocean traversed by the Challenger; the North and South Atlantic, the Australian Sea, Celebes Sea, and throughout the Pacific, from lat. 40° S. to lat. 40° N. It has, moreover, been observed by Claus in the Mediterranean (*Euphausia mülleri*), and a single specimen of the same species was collected by myself off the Norwegian coast (Magerö) in lat. 63° 28′ N.

15. *Euphausia similis*, G. O. Sars (Pl. XIII. figs. 1–6).

Euphausia similis, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 14.

Specific Characters.—Form of body somewhat more slender than in the preceding species. Carapace with only a single, small, lateral denticle at the middle of the inferior margin; rostral projection rather produced, and very acute. Caudal segments smooth above; epimera of fourth and fifth segments small, and slightly emarginate inferiorly. Last segment very elongate; preanal spine diminutive, and simple. Eyes pyriform. Antennular peduncle without any distinct dorsal leaflet. Antennal scale rather broad, ovate, obliquely rounded at the apex, outer corner unarmed. Subapical spines of telson much smaller than in *Euphausia pellucida*, and quite smooth. Inner plate of uropoda shorter than outer. Length reaching 30 mm.

Remarks.—This species is very nearly related to *Euphausia pellucida*, but attains almost twice the size of that form. Moreover, the animal may easily be recognised by the rostrum being considerably more produced, by having but a single lateral denticle on the carapace, by the much shorter and perfectly smooth subapical spines of the telson, and finally, too, by a somewhat different relation in length between the terminal plates of the uropoda, as also by the simple structure of the preanal spine.

Description.—Of the present species the collection contains but one specimen, an adult male. It measures 30 mm., and hence has about double the length of the specimens belonging to the preceding species.

The general form of the body (see Pl. XIII. fig. 1) approximates to that of *Euphausia pellucida*, though perhaps a trifle more slender.

The carapace has the anterior part but very slightly keeled above, and it runs out as a comparatively long and very acute rostral projection, reaching beyond the middle of the basal joint of the antennulæ. On the inferior margin occurs but a single small denticle, placed a little in front of the middle, or somewhat behind the base of the first pair of legs.

The caudal segments are, as in the preceding species, smooth above, and taper out gradually backward. The three anterior pairs of epimera present the usual form, and project not inconsiderably, whereas the two posterior pairs exhibit a somewhat different aspect, projecting, as they do, a trifle less, and having the lower margin slightly incurved, as also the posterior lobe narrowly produced. The last segment is very elongate, and the preanal spine exceedingly small and quite simple, claw-shaped.

The eyes (see fig. 2) are rather large and pyriform, with the cornea greatly expanded.

The antennular peduncle (*ibid.*) exhibits much the same appearance as in *Euphausia pellucida*, but lacks any distinct dorsal leaflet, the basal joint forming at the extremity above only a slight, well nigh imperceptible lobe.

The antennal scale (see fig. 2) is rather broad and oval in form, with the apex obliquely rounded, and the outer angle unarmed. It projects scarcely at all beyond the second joint of the antennular peduncle.

The copulatory appendages to the two first pairs of pleopoda (figs. 3, 4) differ somewhat in their structural details from those in *Euphausia pellucida*. More especially in the first pair, the differences are at once perceptible by comparing fig. 3 of this plate with fig. 28 of Pl. XII., the hook-shaped processes having a somewhat dissimilar form in the two species.

The telson (see fig. 5) is very slender, and distinguished from that in *Euphausia pellucida* more particularly by the subapical spines being much smaller and quite smooth.

As in the preceding species, the uropoda (*ibid.*) do not attain the length of the telson; and as regards the terminal plates—contrary to the relation in *Euphausia pellucida*—the inner are appreciably shorter than the outer.

Habitat.—The above described specimen was taken with the trawl, in the South Atlantic, south-east of Buenos Ayres, having in all probability been brought up from some intermediate stratum of the sea during the hauling up.

Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; depth, 600 fathoms.

16. *Euphausia splendens*, Dana (Pl. XIII. figs. 7–17).

Euphausia splendens, Dana, United States Expl. Exped., vol. xiii., Crustacea, p. 642, pl. xlii. fig. 5, *a–h*.

Euphausia splendens, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 15.

Specific Characters.—Form of body somewhat more robust than in the last two species. Carapace with a single denticle about the middle of the lower margin; anterior part slightly keeled above; rostral projection remarkably short, scarcely projecting beyond the ocular segment. Caudal segments smooth above; epimera rather small and evenly rounded. Last segment longer than preceding; preanal spine simple. Eyes rather large, pyriform. Antennular peduncle without any trace of dorsal lobes, but with a fascicle of very strong curved setæ, springing from off the dorsal face of the basal joint. Antennal scale nearly as in *Euphausia pellucida;* basal spine, however, much shorter. Terminal joint of second pair of maxillæ very large, and ovate in form. Subapical spines of telson smooth. Inner plate of uropoda a little shorter than outer. Length reaching 18 mm.

Remarks.—As the descriptions of Dana are anything but satisfactory, it is somewhat difficult to decide with absolute certainty whether this form be in fact identical

with the *Euphausia splendens* of that author, or belong to some other allied species. Meanwhile, assuming the species so designated by Dana to be almost certainly represented in the rich collection of the Challenger Euphausiidæ, I hold this form to be the one most properly referable to that species. From both the preceding species the present form may be readily distinguished by its robust body, the very short rostral projection, and the strong, curving setæ that spring from the basal joint of the antennulæ.

Description.—The length of the largest specimen reaches about 18 mm., and the species attains accordingly a somewhat larger size than *Euphausia pellucida.*

The general form of the body (see Pl. XIII. fig. 7) would, on the whole, appear to be somewhat shorter and more thickset than in the two preceding species, and this feature, too, is obvious from the figure given by Dana, at least as compared with that of *Euphausia pellucida.*

The carapace, as in *Euphausia similis,* exhibits on either side a single lateral denticle about the middle of the lower margin, or rather just above the point of insertion of the second pair of true legs. Its anterior part has above a well-marked keel, and the frontal margin forms in the middle a very slight rostral projection, or rather an acute angle, scarcely projecting beyond the ocular segment.

The caudal segments are smooth above and furnished with rather small evenly rounded epimera. The last segment is appreciably longer than any of the preceding, and has the preanal spine (fig. 17), as in *Euphausia similis,* quite simple or unguiform, though somewhat stronger than in that species.

The eyes (see fig. 15) are very large and projecting, pyriform, with the cornea much expanded.

The antennular peduncle (fig. 8) is more particularly distinguished by the total absence of any dorsal leaflet or lobe, whereas a bunch of strong, curving bristles is seen to spring from the dorsal face of the basal joint.

The antennal scale (fig. 9) agrees in its form comparatively well with that in *Euphausia pellucida,* though perhaps a trifle more elongate. The basal spine, as in that species, is distinctly denticulate, but very much smaller.

The mandibular palp (fig. 10) exhibits none of the short spiniform bristles peculiar to *Euphausia pellucida.*

The first pair of maxillæ (fig. 11) have the exognath relatively larger, and more oblong in form.

The second pair of maxillæ (fig. 12) are chiefly distinguished by the large size and ovoid form of the terminal joint.

The copulatory appendages of the two first pairs of pleopoda in the male (see figs. 13, 14) exhibit on the whole a structure considerably approximating to that in *Euphausia similis.* Still, however, a few well-marked differences may be found, more especially in

the form of the three hook-shaped processes on the appendages of the first pair, as shown in the respective figures (compare figs. 3 and 13).

The telson and uropoda (fig. 16) would not seem to differ essentially from those parts in *Euphausia similis*.

Colour.—According to Dana, this species, in a living state, is more or less tinged with red or purple, especially along the ventral face of the body.

Habitat.—The specimens in the collection were taken at the surface of the sea in the following localities, as shown in the table :—

Date.	Locality.
December 17, 18, 1873.	Off Cape of Good Hope.
October 21, 1875.	South Pacific, about midway between New Zealand and Chili.
January 21, 1876.	South Atlantic, Cape Virgins to Falkland Islands.
February 11, 1876.	South Atlantic, Falkland to Buenos Ayres.

The specimens examined by Dana were collected in the tropical region of the Atlantic (lat. 2° N.).

Distribution.—The distribution of the present species, as yet known, would accordingly seem to be chiefly restricted to the southern parts of the Atlantic and Pacific Oceans.

17. *Euphausia murrayi*, G. O. Sars (Pl. XIV. figs. 1–4).

Euphausia murrayi, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 16.

Specific Characters.—Form of body somewhat more slender than in *Euphausia splendens*. Carapace rather elongate, with a single lateral denticle, placed in front of the middle of the inferior margin ; anterior part very slightly keeled above ; rostral projection short ; frontal margin forming on either side, above the eyes, an obtuse angle. Caudal segments smooth above, with rather deep epimera, the posterior pair triangular, produced posteriorly. Last segment not much longer than preceding ; preanal spine obsolete. Eyes short and thick, claviform. Antennular peduncle provided above at the end of the basal joint with an anteriorly pointing lobe, obliquely emarginate at the tip. Antennal scale oblong, truncate at apex, denticle of outer angle very small. Gill-trunks very broad and flattened, with numerous exceedingly slender, well-nigh filiform lobules. Telson with three pairs of dorsal denticles ; subapical spines smooth. Inner plate of uropoda very slightly overreaching outer. Length attaining 43 mm.

Remarks.—Next to *Euphausia superba*, this *Euphausia* is the largest in the collec-

tion, and admits of being distinguished from *Euphausia splendens*, to which form it bears a close relationship,—except in its much larger size,—by a somewhat more slender form of body, the comparatively shorter eyes, the presence of a well-marked cuticular lobe at the end of the basal joint of the antennulæ, the peculiar expanded form of the gills, and finally by the form of the posterior pair of caudal epimera.

Description.—Of this species, the collection has two specimens, the larger of which reaches a length of 43 mm. Both are females.

The form of the body (see Pl. XIV. fig. 1) would seem to be a trifle more slender than in *Euphausia splendens;* the anterior division in particular is appreciably more elongate as compared with the posterior.

The carapace, as in *Euphausia splendens*, has on either side a distinct lateral denticle, which, however, occurs somewhat in front of the middle of the lower margin. Its anterior part is very slightly keeled above, and marked off by a distinct cervical impression. The rostral projection (see fig. 2) is very short and triangular, but slightly overreaching the ocular segment, and, moreover, rather sharply defined from the frontal margin, which on either side exhibits an obtuse angle above the eyes.

The caudal segments are smooth above, and provided with rather deep, irregularly rounded epimera. Those on the penultimate segment are, however, somewhat dissimilar, being rather produced in the form of acute, triangular plates, pointing backwards and overlapping the last segment. This, too, is but very little, if at all, longer than the preceding, and does not exhibit any trace of a preanal spine.

The eyes (see fig. 2) are rather short and thick, almost clavate, and but slightly projecting on either side.

The antennular peduncle (*ibid.*) is comparatively elongate, and has a distinct cuticular lobe projecting, above, from the end of the basal joint, as also another much smaller one, exteriorly, at the end of the second joint. Both the lobes are extended horizontally, and exhibit a somewhat triangular form, the larger one is also obliquely emarginate at the tip.

The antennal scale (*ibid.*) projects a little beyond the second joint of the antennular peduncle and has a rather elongate, oblong-linear form, with the apex narrowly truncate and the denticle of the outer corner very small, though quite distinct.

The gills (fig. 3) are characterised by a somewhat unusual form of the trunk, which is greatly expanded and flattened, well-nigh semilunar, and has affixed to the outer convex edge a very considerable number of exceedingly slender, nearly filiform gill-lobules. The posterior pairs of gills (see fig. 1) are richly arborescent, exhibiting an abundance of curved secondary branches.

The telson (see fig. 4) exhibits the usual slender form, and has three pairs of small dorsal denticles. The subapical spines were broken in the larger specimen; in the smaller one they are of moderate size and quite smooth.

The uropoda (see fig. 4) reach very nearly to the tip of the telson, and have the inner plate projecting slightly beyond the outer.

Habitat.—The two specimens secured were taken at the following localities :—

Date.	Locality.
January 27, 1874. February 19, 1874.	Southern Ocean, off Kerguelen, in trawl, 96 fathoms. Antarctic Ocean (Station 154), near ice-barrier.

Distribution.—The distribution of the species, as yet known, would accordingly seem to be restricted to the Southern and Antarctic Oceans.

18. *Euphausia superba*, Dana (Pl. XIV. figs. 5–9).

Euphausia superba, Dana, United States Exploring Expedition, vol. xiii., Crustacea, p. 645, pl. xliii. fig. 1, *a–o*.
Euphausia superba, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 17.

Specific Characters.—Body rather compressed. Carapace narrow, without any lateral denticle; anterior part scarcely at all keeled above; rostral projection very small, and obtusely rounded. Caudal segments smooth above, with very large epimera. Last segment short, not longer than preceding; preanal spine obsolete. Eyes large, pyriform. Antennular peduncle very strong, having above, at the end of the basal joint, a small, cordiform lobe. Antennal scale comparatively short, ovate, apex obliquely rounded. Exopods of legs, as also pleopods, very powerfully developed. Gills well-nigh as in *Euphausia murrayi*. Telson with apex very slightly produced; subapical spines slender and smooth. Uropoda reaching beyond tip of telson, inner plate shorter than outer. Length attaining 48 mm.

Remarks.—There cannot, I think, be any doubt whatever as to the identity of the form treated of here with Dana's *Euphausia superba*, and, moreover, the specimen in the collection had been labelled with that name by the late Dr. v. Willemoes-Suhm. It is readily distinguished from all the preceding species, not only by its large size, but also by the very short and obtuse rostral projection, the absolute want of lateral denticles on the carapace, the remarkably thick antennular peduncles, and the powerful development both of exopods and pleopods.

Description.—The solitary specimen procured during the Expedition is an adult male, measuring 48 mm. in length.

The general form of the body (see Pl. XIV. fig. 5) is as in *Euphausia murrayi*, though comparatively more compressed.

The carapace is rather narrow, and lacks every trace of lateral denticles, and,

moreover, does the anterior part exhibits no distinct keel above. The rostral projection (fig. 6) is exceedingly short, reaching but very slightly beyond the ocular segment, and the frontal margin does not form any angle above the eyes, as in the preceding species.

The caudal segments are very powerfully developed, and, as in the preceding species, smooth above. The epimera are rather deep and irregularly rounded in form, except the posterior pair, which, as in *Euphausia murrayi*, are triangular and produced. The last segment does not exceed in length the preceding, and would seem to lack the preanal spine.

The eyes (see fig. 6) are very large and protruding, pyriform, with the cornea very much expanded.

The antennular peduncle (*ibid.*) exhibits an exceedingly robust structure, and has a well marked cordiform lobe, projecting above from the end of the basal joint.

The antennal scale (*ibid.*) is comparatively short, scarcely reaching to the end of the second joint of the antennular peduncle; it exhibits an oval form, with the apex somewhat obliquely rounded and the denticle of the outer corner very small, almost obsolete.

The gills (see fig. 5) would, on the whole, seem to agree in structure with those of *Euphausia murrayi.*

The exopods on the maxillipeds and legs, as also the pleopods, are very powerfully developed, more so than in any other known species.

The copulatory appendages to the first pair of pleopoda (fig. 7) closely resemble those in *Euphausia splendens;* still, however, some few differences in detail may be discerned. Thus, for example, the outer process and the secondary hook of the inner one are quite simple, and strongly curved, whereas these parts in *Euphausia splendens* are bidentate at the apex. The appendages of the second pair of pleopoda (fig. 8) are comparatively shorter, reaching but very little beyond the apex of the principal plate.

The telson (see fig. 9) is comparatively shorter than in the other species, with the apex very slightly produced and obtusely pointed. The subapical spines are exceedingly slender and quite smooth.

The uropoda (*ibid.*) reach somewhat beyond the tip of the telson, and have the inner plate appreciably shorter than the outer.

Colour.—According to the statements of Dana, this species, in a living state, is characterised by a very conspicuous colouring, the whole body, save the legs and gills, being tinged with a brilliant red.

Habitat.—The above described specimen was taken at the surface of the sea, along with the larger specimen of *Euphausia murrayi*, February 19, 1874, in the Antarctic Ocean, at Station 154. Dana obtained this species, too, in the Antarctic Ocean, south of Van Diemen's Land, in lat. 66° 5′ S., long. 157° E.

19. *Euphausia antarctica*, G. O. Sars (Pl. XV. figs. 1–8).

Euphausia antarctica, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 18.

Specific Characters.—Form of body rather slender, with tail less powerful in development than is generally the case. Carapace without any lateral denticle; anterior part slightly keeled above and projecting as a broad, triangular, frontal plate. Caudal segments smooth above, with remarkably small, rounded epimera. Last segment slightly exceeding in length the preceding, with a minute, simple, preanal spine. Eyes claviform. Antennular peduncle slender, without any dorsal lobe, but with the outer corner of the basal joint produced into a sharp spine. Antennal scale oblong-linear, obtusely truncate at apex, outer corner jutting out as a well marked dentiform projection. Mandibular palp remarkably slender, with terminal joint linear. Last joint of second pair of maxillæ oblong-ovate. Legs very elongate and densely setose. Telson with three pairs of dorsal denticles; subapical spines moderate in size, smooth. Uropoda much shorter than telson, inner plate slightly overreaching outer. Length 17 mm.

Remarks.—This is a rather anomalous form, and readily distinguished from all the other species by the remarkably narrow tail and very slender legs, as also by the broad triangular frontal plate and the form of the antennal scale.

Description.—All the specimens collected are females, and the largest measures about 17 mm. in length.

The form of the body (see Pl. XV. fig. 1) is rather slender, and the proportion between the anterior and posterior divisions somewhat different from that observed in most of the other species, the tail being relatively far less powerfully developed.

The carapace lacks every trace of lateral denticles, the inferior margin being quite smooth and but very slightly incurved along their anterior part. The antero-lateral angles of the carapace project considerably and are acutely angular; the frontal part (see fig. 2) protrudes over the base of the eyes as a broad horizontally extending plate of triangular form, reaching nearly to the middle of the basal joint of the antennulæ. From the base of the plate, a slight dorsal keel is seen to extend backwards along the anterior part of the carapace.

The caudal segments are smooth above and rather narrow, the epimera being comparatively very small and evenly rounded. The last segment but slightly exceeds in length the preceding, and has a very small, simple preanal spine (fig. 4), mostly hidden between the bases of the uropoda.

The eyes (see fig. 2) project considerably, but have the cornea not very much expanded, with the greatest breadth about the middle of the pedicle.

The antennular peduncle (*ibid.*) is comparatively slender, and lacks every trace of dorsal lobes, but has the outer corner of the basal joint jutting forth as a sharp, spiniform projection.

The antennal scale (see fig. 2) exhibits a form somewhat different from that in the other species, being rather elongate, oblong-linear, and projecting a little beyond the second joint of the antennular peduncle. The apex is obtusely truncate, and the outer angle juts out into a well marked, dentiform projection.

The mandibular palp (fig. 5) is very slender, its terminal joint being nearly as long as the median, but very much narrower, linear, and armed with six spiniform bristles, increasing gradually in length toward the apex.

The first pair of maxillæ (fig. 6) have the exognath very large and oval in form, but in other respects resemble those of *Euphausia splendens*.

The second pair of maxillæ (fig. 7) are more particularly distinguished by the remarkable size and oblong-ovate form of the terminal joint.

The legs are very slender and elongate, the ischial joint being much the largest, and in the fifth pair (fig. 8) exceeding in length even all the succeeding joints taken together. They are, moreover, furnished with a very dense fringe of remarkably long and delicate setæ.

The gills (see figs. 1, 8) would seem, on the whole, to agree comparatively closely in structure with those of *Euphausia pellucida*.

The telson (see fig. 3) about equals in length the two posterior segments taken together, exhibiting a somewhat less slender form than in the other species, rather flattened throughout and tapering but slightly, with the apex lanceolate. It is armed with three pairs of very small dorsal denticles, exclusive of the subapical spines, which are rather strong and smooth.

The uropoda (*ibid.*) are much shorter than the telson, and have the inner plate slightly projecting beyond the outer.

Habitat.—Of this species, numerous specimens were collected in a single locality, viz., at the ice-barrier in the Antarctic Ocean. They were, as usual, taken in the tow-net, at the surface of the sea. The locality is as follows :—

Station 153, February 14, 1874 ; lat. 65° 42′ S., long. 79° 49′ E.

Moreover, several very young specimens and larvæ, apparently of the same species, were collected in two other localities near that stated above, viz., at Stations 152 and 156.

Hence there cannot, I think, be the slightest doubt as to this species constituting a form quite peculiar to the Antarctic region.

20. *Euphausia mucronata*, G. O. Sars (Pl. XV. figs. 9–11).

Euphausia mucronata, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 19.

Specific Characters.—Form of body as in *Euphausia splendens*. Carapace with a single lateral denticle, about the middle of the inferior margin ; anterior part having a

well-marked rounded crest above; rostral projection very short. Caudal segments with fully developed epimera; third segment jutting out posteriorly as a strong dorsal spine, pointing backwards. Last segment rather elongate; preanal spine obsolete. Eyes very large, pyriform. Antennular peduncle without any dorsal lappet. Antennal scale oblong, apex narrowly truncate, outer angle unarmed. Telson elongate, tapering, with two pairs of dorsal denticles; subapical spines strong and diverging, smooth. Inner plate of uropoda scarcely at all projecting beyond outer. Length reaching 14 mm.

Remarks.—This species somewhat resembles *Euphausia splendens*. It may, however, at once be distinguished by the strong spiniform projection of the third caudal segment, a character from which the specific name is derived.

Description.—The specimens in the collection are not in the best state of preservation, but yet distinctly exhibit the prominent characters of the species. All of them are females, and the largest specimen has a length of about 14 mm.

The form of the body (see Pl. XV. fig. 9) approximates, on the whole, a good deal to that of *Euphausia splendens*, the tail being powerfully developed and well nigh twice the length of the anterior division.

The carapace has on either side a distinct lateral denticle, placed about the middle of the inferior margin, or above the point of insertion of the second pair of legs. The anterior part exhibits a very conspicuous rounded dorsal crest, and juts out as an exceedingly short rostral projection, reaching but little beyond the ocular segment.

The caudal segments have rather deep epimera, of a rounded form, except the last pair, which are triangular. The third segment juts out dorsally into a well-marked, mucroniform spine, pointing backwards, and at the end of the penultimate segment a similar but very small projection occurs. The last segment is rather produced, about as long as the two preceding ones taken together, and would seem to lack the preanal spine.

The eyes (see fig. 10) occur very large and protruding, pyriform, with the cornea greatly expanded.

The antennular peduncle (*ibid.*) does not exhibit any distinct dorsal lappet. A very small protrusion of the anterior margin of the basal joint may, however, possibly be considered the rudiment of such a part.

The antennal scale (*ibid.*) reaches a little beyond the second joint of the antennular peduncle, exhibiting an oblong form, with the apex narrowly truncate and the outer angle unarmed.

The oral parts and the legs would not seem to differ materially from those of *Euphausia splendens*.

The telson (see fig. 11) is rather elongate, and tapers gradually toward the apex, which is lanceolate and pointed. The subapical spines are strong and diverging, but

quite smooth. Moreover, two pairs of small dorsal denticles occur on the posterior half of the telson.

The uropoda (see fig. 11) are much shorter than the telson, and have the terminal plates uniform in length.

Habitat.—This species was obtained on November 18, 1875, in the South Pacific, off the coast of Chili, where a few specimens were taken at the surface of the sea.

21. *Euphausia gracilis*, Dana (Pl. XV. figs. 12–23).

Euphausia gracilis, Dana, United States Exploring Expedition, vol. xiii., Crustacea, p. 644, pl. xlii. figs. 6, *a–c*.
Euphausia gracilis, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 20.

Specific Characters.—Form of body very slender and elongate. Carapace with a single lateral denticle about the middle of the inferior margin; anterior part very slightly keeled above; rostral projection sharply pointed. Caudal segments smooth above, with very small rounded epimera. Last segment rather elongate; preanal spine simple. Eyes remarkably small, with the cornea scarcely at all expanded. Antennular peduncle without any dorsal lappet, basal joint shorter than the other two taken together. Antennal scale oblong-ovate, apex obtusely truncate, outer corner unarmed. Gills rather simple in structure, with but few digitiform lobules. Telson with two pairs of dorsal denticles; subapical spines smooth. Inner plate of uropoda much longer than outer, and reaching the tip of the telson. Length about 10 mm.

Remarks.—This form is without doubt the *Euphausia gracilis* of Dana, and in every way entitled to its specific designation, being by far the most slender species of the genus. Moreover, the animal can be recognised by its remarkably small eyes.

Description.—The length would not seem to exceed 10 mm., and accordingly the present species must take rank among the smallest belonging to this family.

The form of the body (see Pl. XV. fig. 12) appears exceedingly slender; the tail in particular is very elongate, attaining, as it does, more than twice the length of the anterior division.

The carapace is rather narrow, and exhibits on either side a single lateral denticle, placed about the middle of the inferior margin, or, more precisely, just above the point of insertion of the second pair of legs. Its anterior part is very slightly keeled above, and juts out as an acutely pointed rostral projection, reaching considerably beyond the ocular segment.

The caudal segments are quite smooth above, and have the epimera very small and rounded, but slightly projecting beneath the ventral face. The last segment is very elongate and compressed, even a trifle longer than the two preceding segments

taken together. The preanal spine (fig. 19) is exceedingly narrow and acutely pointed.

The eyes (see fig. 20) are distinguished by their remarkably small size, and almost fusiform shape, the cornea not being at all expanded, and the greatest thickness occurring in the middle of the pedicle.

The antennular peduncle (fig. 13) does not exhibit any trace of dorsal lappets. The basal joint is rather broad, but shorter than the two succeeding joints taken together. The middle joint forms at the end, above, a slight projection, reaching over the base of the terminal joint, and provided with a dense row of delicate bristles.

The antennal scale (fig. 14), slightly projecting beyond the second joint of the antennular peduncle, exhibits an oblong-ovate form, with the apex narrowly truncate and the outer corner unarmed. The basal spine is rather elongate, reaching nearly to the middle of the scale, and is armed at the inner edge with a row of strong denticles. The basal part of the flagellum appears rather powerful, but does not nearly attain the length of the scale.

The mandibular palp (fig. 15) has the terminal joint very small and oval in form; it is armed with five ciliated spines on the inner edge, and a single bristle on the outer.

The first pair of maxillæ (fig. 16) exhibit much the same appearance as in *Euphausia antarctica*.

The second pair of maxillæ (fig. 17) have the terminal joint not very large, of a rather regular ovoid form, and but sparingly supplied with bristles.

The maxillipeds and legs exhibit, on the whole, the usual structure, and have the outer joints somewhat flattened.

The gills are comparatively simple in structure and provided with a somewhat limited number of digitate lobules. The posterior pair (fig. 18), which, in other species, are richly arborescent, consist of only three comparatively short branches, one of which is bent inwards.

The copulatory appendages to the two first pairs of pleopoda in the male are rather strongly developed. Those on the first pair (fig. 22) have the outer process securiform, or projecting into two hook-shaped processes, pointing in opposite directions; the middle one is strongly bent, and finely dentate at the tip; the inner process finally has the secondary hook serrate at the outer edge. The appendages of the second pair (fig. 23) jut out into three rather broad and somewhat twisted lobes, reaching considerably beyond the apex of the principal plate.

The telson (see fig. 21) exhibits the usual slender form, and is armed with two pairs of small dorsal denticles, exclusive of the subapical spines. The latter (broken off in the specimen examined by Dana) are rather strong, but quite smooth and slightly divergent.

The uropoda (see fig. 21) have the inner plate much longer than the outer, and, when exserted posteriorly, reaching the tip of the telson.

Colour.—According to Dana, the animal, in a fresh state, is quite pellucid, without any distinct pigment.

Habitat.—A good many specimens of the present species were collected by the Expedition in different tracts of the ocean. They were all taken at the surface of the sea. The following is a list of localities, with the dates at which the specimens were obtained :—

Date.	Locality.
August 16, 1873.	Tropical Atlantic, off African coast.
June 8, 1874.	Australian Seas, off Port Jackson.
August 25, 1874.	West Pacific, Api to Cape York.
February 6, 1875.	Celebes Sea, off Mindanao.
August to September, 1875.	Tropical Pacific.
April 26, 1876.	Tropical Atlantic, off St. Vincent, Cape Verde Islands.

Dana took this form in the Pacific, lat. 15° 23′ S., long. 148° 23′ W.

Distribution.—Hence the species would seem to occur chiefly in the tropical parts of the Atlantic and Pacific Oceans, ranging southward to the Australian Seas.

22. *Euphausia gibba*, G. O. Sars (Pl. XVI. figs. 1–8).

Euphausia gibba, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 21.

Specific Characters.—Form of body very slender. Carapace with a single lateral denticle, placed behind the middle of the inferior margin; rostral projection acutely pointed. Tail gibbous in the middle, with the third segment projecting, posteriorly, as an acute dorsal lappet, overlapping the succeeding segment. Last segment very elongate; preanal spine simple. Eyes rather small, slightly expanded at the tip. Basal joint of antennulæ with a very small bifid lappet at the end above. Antennal scale rather large, oblong-ovate, apex obtusely truncate, outer corner unarmed. Telson as in *Euphausia gracilis*. Inner plate of uropoda scarcely at all extending beyond outer, and not reaching tip of telson. Length about 15 mm.

Remarks.—In its external form this species very closely resembles the preceding, but may, on closer examination, be easily recognised by the peculiar gibbous form of the tail and the dorsal lappet projecting from its third segment.

Description.—The largest specimens attain a length of 15 mm., and hence the species slightly exceeds the preceding one in size.

The form of the body (see Pl. XVI. fig. 1) is very slender, though perhaps less so than in *Euphausia gracilis.*

The carapace is very similar in form and structure to that of *Euphausia gracilis,* with this exception, however, that the lateral denticle does not occur in the middle of the inferior margin, having a somewhat posterior position, just above the point of insertion of the third pair of legs. The rostral projection (see fig. 2) would appear to be a trifle narrower and very acute.

The caudal segments are on the whole more powerfully developed than in the preceding species, the epimera being also larger and more projecting inferiorly. The third segment in all the specimens forms a very conspicuous angle with that succeeding it, giving to the tail in the middle, as it were, a geniculate appearance or gibbous character, precisely as in several Caridea, for example the genus *Hippolyte.* As in that genus, moreover, an acutely pointed lappet is seen to project posteriorly from the dorsal face of the third segment, arching over the base of the following segment, to which it is closely applied when the tail is fully extended. The last segment, very elongate and slightly compressed, is about as long as the two preceding segments taken together. The pre-anal spine is nearly the same as in *Euphausia gracilis,* though in some examples a small secondary tooth occurs at its base.

The eyes (see fig. 2) are comparatively very small, but have the cornea distinctly expanded, whereby they acquire a more regular pyriform shape than in *Euphausia gracilis.*

The antennular peduncle (*ibid.*) exhibits a structure very similar to that of the preceding species, with this exception, however, that a small bifid lappet (fig. 4) occurs at the end of the basal joint above.

The antennal scale (fig. 5) is rather large, reaching appreciably beyond the second joint of the antennular peduncle; it appears, too, relatively broader as compared with that in *Euphausia gracilis,* and has an ovate form, with the apex obtusely truncate and the outer corner unarmed. The basal spine is very slender, and, as in *Euphausia gracilis,* denticulate along the inner edge.

The oral parts and the legs would not seem to exhibit any essential difference from those of *Euphausia gracilis.*

The gills are comparatively more fully developed, being furnished with a greater number of lobules, and the last pair (fig. 8) have five lobuliferous branches.

The copulatory appendages to the first pair of pleopoda in the male (fig. 6), although developed much as in *Euphausia gracilis,* still show well-marked specific differences in their structural details. Thus, the middle process exhibits a very extensive development, being highly chitinised, and bent in the middle to a hook-shaped form, whereas the two other processes are comparatively feeble in structure. The appendages of the second pair of pleopoda (fig. 7) differ but slightly from those in *Euphausia gracilis.*

The telson (see fig. 3) exhibits almost exactly the same structure as in *Euphausia gracilis*.

The uropoda (*ibid.*), on the other hand, differ essentially as regards the inner plate, which is relatively shorter, scarcely at all exceeding in length the outer, and do not nearly reach the tip of the telson.

Habitat.—Of this species, too, the collection comprises comparatively numerous specimens, all of which were taken at the surface of the sea. The following is a list of the localities, with the dates at which they were obtained :—

Date.	Locality.
February to March, 1873.	Atlantic, between Tenerife and St. Thomas.
August 11, 12, 1874.	Pacific, off Kandavu, Fiji Islands.
August 25, 1874.	West Pacific, Api to Cape York.

The distribution of the species would, therefore, seem to be much the same as that of the preceding species, comprising, as it does, the tropical regions of the Atlantic and Pacific Oceans.

23. *Euphausia spinifera*, G. O. Sars (Pl. XVI. figs. 9–16).

Euphausia spinifera, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 22.

Specific Characters.—Form of body somewhat robust. Carapace with a very strong, lateral denticle, placed in a sinus above the inferior margin, a trifle posterior to the middle; anterior part provided with an elevated crest forming midway an erect denticle; rostral projection remarkably strong, straight, acuminate; frontal margin armed with a pair of sharp-pointed supra-orbital spines. Caudal segments with large epimera; third segment projecting posteriorly as a sharp, mucroniform, dorsal spine; posterior margin of the two succeeding segments divided into several sharp-pointed lappets. Last segment elongate; preanal spine bidentate. Eyes short and thick. Antennular peduncle with a broad, indented lappet projecting from the basal joint above. Antennal scale oblong-linear, narrowly truncate at apex, outer corner projecting as a well-marked tooth. Telson very slender, with five pairs of small dorsal denticles; subapical spines finely denticulate at inner edge. Uropoda much shorter than telson, inner plate extending slightly beyond outer. Length reaching 26 mm.

Remarks.—This is a very distinct species, and easily recognised by the remarkably strong rostral projection and the spiny armature both of the anterior and posterior divisions of the body.

Description.—Four specimens only of this form were collected, the largest of which, a male, has a length of 26 mm.

The form of the body (see Pl. XVI. fig. 9) appears much more robust than in the two preceding species, and a good deal compressed.

The carapace is rather short in proportion to its height, and has on either side, posterior to the middle, a very strong denticle, which, however, does not, as is generally the case, project from the inferior margin, but occurs at some distance above it, arching over a sinus, from which a ridge extends anteriorly, joining the margin at the side of the mandibles. The anterior part of the carapace is provided with a very marked dorsal crest, jutting out in the middle as an erect tooth. The rostral projection is remarkably strong, projecting horizontally as a sharp dagger-like process, reaching nearly to the end of the basal joints of the antennulæ. Above the eyes, moreover, the frontal margin juts out, on either side, as a well-marked, somewhat upturned dentiform projection, or supra-orbital spine.

The caudal segments are powerfully developed, and provided with rather large lamellar epimera. Of these the two anterior pairs are almost quadrangular, whereas the three posterior ones exhibit a more pronounced triangular form, their posterior angle being slightly produced. The third segment, as in *Euphausia mucronata*, projects posteriorly as a strong dorsal spine, pointing straight backwards, and has, moreover, extending from the posterior margin, on either side an angular lobe. Again, the two succeeding segments are distinguished by their posterior margin being divided into several pointed lappets, one of which occupies the median line dorsally. The last segment is much narrower and more elongate than the other, although not attaining the length of the two preceding segments taken together. The preanal spine (fig. 16) is distinctly bidentate, or has a rather strong secondary tooth at the posterior edge.

The eyes (see figs. 9, 10) are very short and thick, almost globular, with the cornea exceedingly expanded.

The antennular peduncle (*ibid.*) is rather slender, and distinguished more particularly by the presence of a broad, but very thin and membranous, dorsal lobe, extending from the end of the basal joint and overlapping the base of the succeeding joint. This lobe, too, is divided at the edge into several acute lappets (see fig. 12), somewhat irregularly disposed, and forming two or three bunches. Another and very much smaller lobe is found to project from the second joint, being almost spiniform in shape, with a small lateral lappet proceeding from the outer edge (see fig. 13).

The antennal scale (see fig. 10) projects appreciably beyond the second joint of the antennular peduncle, and exhibits an oblong-linear form, with the apex narrowly truncate and the outer corner jutting out as a well marked dentiform projection.

The oral parts could not be more closely examined for want of sufficient specimens.

The structure of the maxillipeds and the legs, as also that of the gills, would seem not to differ essentially from that observed in the other species of the genus.

The copulatory appendages to the two first pairs of pleopoda in the male (see figs. 14, 15) are in every respect normal in structure, although certain slight specific differences can indeed be found by comparing them with those parts in other species.

The telson (see fig. 11) is very slender and elongate, attaining the length of the two preceding segments taken together, and exhibits no less than five pairs of minute dorsal denticles. The subapical spines are of moderate size, reaching but slightly beyond the lanceolate tip of the telson, and have their inner edge finely denticulate.

The uropoda (*ibid.*) are much shorter than the telson, and have the inner plate very narrow and only slightly overreaching the outer.

Habitat.—The four specimens procured, three of which have been mounted in glycerine on glass slides, were taken at the surface of the sea, in the following localities:—

Date.	Locality.
May 9, 10, 1874.	South of Australia, lat. 48° 18′ S., long. 30° 11′ E.
October 21, 1875.	South Pacific, about midway between New Zealand and Chili.
October 22, 1875.	South Pacific.

The distribution of this species as yet known, would accordingly seem to comprise the southern part of the Pacific Ocean.

24. *Euphausia latifrons*, G. O. Sars (Pl. XVI. figs. 17–23).

Euphausia latifrons, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 23.

Specific Characters.—Form of body rather short. Carapace without any lateral denticle; rostral projection very peculiar in shape, forming, as it does, a broad, quadrate plate abruptly truncate at the apex. Caudal segments smooth above, with comparatively small, rounded epimera. Last segment longer than preceding, and jutting out at the end dorsally as a short dentiform projection; preanal spine small, unguiform. Eyes clavate, cornea but slightly expanded. Antennular peduncle with a short serrate lobe extending from the basal joint above. Antennal scale subovate, apex rounded, outer corner armed with a distinct tooth. Telson with three pairs of dorsal denticles, subapical spines serrate along the inner edges. Inner plate of uropoda reaching slightly beyond outer. Length scarcely exceeding 8 mm.

Remarks.—The small size of this animal, in conjunction with the peculiar shape of the frontal plate, induced me at first to regard it merely as a larval stage of some other

form of Euphausiidæ. On closer examination, however, I felt convinced of its constituting a new and peculiar species of the genus *Euphausia*, that retained, so to speak, in the adult state, certain apparently larval characteristics. After the plate had been printed, I found among specimens of Euphausiidæ from Port Jackson, a few male examples of somewhat larger size than the one here figured, but, for the rest, closely agreeing with it in all essential characters. The most striking feature in the present species is unquestionably the very peculiar form of the frontal projection, from which character, indeed, the specific denomination has been derived.

Description.—None of the specimens exceed a length of 8 mm., most indeed are rather smaller, and hence the species may be regarded as a true pigmy form.

The body (see Pl. XVI. fig. 17) is rather short, the tail measuring about twice the length of the anterior division.

The carapace has no trace of lateral denticles, the inferior margin being quite smooth and slightly incurved. The anterior part does not exhibit any distinct keel above; it projects as a broad, well nigh quadrate plate, arching over the base of the eyes, and reaching about the middle of the basal joint of the antennulæ. This plate, too, is slightly hollowed along the middle, and at the apex abruptly truncate, or sometimes even slightly emarginate, with distinctly projecting lateral corners.

The caudal segments are smooth above and provided with comparatively small, rounded epimera. The last segment is a trifle more elongate than the preceding, and juts out at the end above as a small dentiform projection (see fig. 22). The preanal spine is very small, and unguiform.

The eyes (see fig. 18) exhibit a somewhat clavate form, having their greatest thickness in the middle of the pedicle, the cornea not being at all expanded.

The antennular peduncle (*ibid.*) is provided at the end of the basal joint above, with a very thin and membranous lobe (see fig. 19), serrate at the edge and overlapping the base of the succeeding joint. The outer corner of the basal joint is, moreover, drawn out to a strong, anteriorly pointing spine.

The antennal scale (see fig. 18) scarcely projects beyond the second joint of the antennular peduncle, and exhibits an oblong-ovate form, with the apex narrowly rounded and the outer corner drawn out to a distinct, although short, dentiform projection.

The oral parts and the legs do not seem to exhibit any essential structural peculiarities.

The gills are, on the whole, not particularly developed, the digitate lobules being in comparison few in number and the posterior pairs but slightly arborescent.

The copulatory appendages to the first pair of pleopoda in the male (see fig. 20) differ somewhat in structure from those in other species of the family, being, on the whole, much simpler, and without the strong hamiform processes generally observed. They

consist merely of three thin membranous plates, of which the median is the longest, and quite unarmed, whereas the outer one exhibits two short spiniform bristles at the apex; the inner plate is very narrow, and may strictly be regarded as the secondary lobe of the principal plate. The appendages to the second pair of pleopoda (see fig. 21) are more normal in structure, but rather small, projecting slightly beyond the apex of the principal plate.

The telson (see fig. 22) is of the usual slender form, with three pairs of small dorsal denticles. The subapical spines (see fig. 23) are rather strong, and have the inner edges finely denticulate.

Habitat.—The specimens procured during the Expedition were collected at the surface of the sea in the following localities:—

Date.	Locality.
April 4, 1874.	Off south-east coast of Australia.
June 8, 1874.	Australian Seas, off Port Jackson.
September 13, 1874.	Arafura Sea.
October 23, 1874.	Celebes Sea, off Mindanao, Philippine Islands.

The distribution of the species would accordingly seem to be restricted to the Australian Seas and those of the Indian Archipelago.

Genus 2. *Thysanopoda*, Milne-Edwards, 1830.

Thysanopoda, Milne-Edwards, Ann. d. Sci. Nat., t. xix.

Generic Characters.—General aspect as in *Euphausia*. Flagella of both pairs of antennæ greatly elongate. Exognath of second pair of maxillæ very small. Maxillipeds and anterior pairs of legs nearly as in *Euphausia*. Penultimate pair of legs distinctly developed, and of the same structure as the preceding; last pair with the endopod obsolete, but having a well-developed exopod. All the true gills provided with an interiorly bent branch; the two posterior pairs rather complex in structure, last pair much the larger and richly arborescent. Luminous globules as in *Euphausia*.

Remarks.—The present genus—that first established in the family—was founded on a form procured from the Atlantic and described by Milne-Edwards under the name of *Thysanopoda tricuspidata*. Neither this typical species, nor other forms strictly belonging to the present genus, have been recorded by any subsequent naturalists; for all the forms since described as Thysanopods ought, in my judgment, to be referred to different genera of the family. The present genus—in the restriction here adopted—is chiefly characterised by the penultimate pair of legs being fully developed and having a structure quite similar to that of the preceding pairs, whereas in the last pair the endopod is wholly wanting, the exopod only being of normal development. Moreover, in the

structure of the gills the genus shows marked differences as compared with other Euphausiidæ. In addition to the typical species first described by Milne-Edwards, three other very distinct species, apparently belonging to this genus, are represented in the Challenger collection, and will be described more in detail in the sequel. I give here a synopsis of the four species as yet known to belong to this genus.

Carapace
- with two strong lateral denticles. Rostral projection sharply pointed, and having posteriorly at its base a flattened, forward-pointing spine. Tail with the four hind segments produced posteriorly to short dorsal spines, ... — *T. tricuspidata*, M.-Edw.
- with a single lateral denticle. Rostrum short, acuminate. Carapace and tail smooth above. Eyes remarkably small, . . . — *T. microphthalma*, n. sp.
- without any lateral denticles. Frontal part
  - obtusely rounded. Caudal segments smooth above, ... — *T. obtusifrons*, G. O. Sars.
  - produced to a distinct compressed rostrum and having an elevated crest above. Fourth and fifth caudal segments produced posteriorly to small dorsal denticles, ... — *T. cristata*, G. O. Sars.

25. *Thysanopoda tricuspidata*, Milne-Edwards (Pl. XVII.).

Thysanopoda tricuspidata, Milne-Edwards, Ann. d. Sci. Nat., t. xix. p. 451, pl. xix.
Thysanopoda tricuspidata, Milne-Edwards, Hist. nat. des Crustaces, t. ii. p. 463, pl. xxvi. figs. 1–6.
Thysanopoda tricuspidata, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 24.

Specific Characters.—Body rather slender, with the tail slightly bent in the middle. Carapace armed with two strong lateral denticles at the inferior margin; frontal part produced to a sharp-pointed rostrum, and having above, in the middle, a flattened anteriorly directed spine. Third caudal segment projecting posteriorly as a strong dorsal spine; the three posterior segments armed with similar, but much smaller spines. The two anterior pairs of caudal epimera curved anteriorly; first pair very large and divided into two acuminate lappets. Last segment rather elongate; preanal spine bidentate. Eyes large and projecting, pyriform. Antennular peduncle slender, cylindrical, with a small narrow lanceolate lappet at the end of the first and second joints above. Antennal scale oblong-linear, apex narrowly rounded, outer corner jutting out as a small denticle. Penultimate pair of legs much smaller than preceding. Telson with four pairs of dorsal denticles, apex greatly produced, and armed close to the tip with two pairs of exceedingly minute secondary teeth; subapical spines of moderate length, smooth. Uropoda shorter than the telson, inner plate a little longer than the outer. Length 24 mm.

Remarks.—I have felt some doubt in referring this form to the typical species, as neither the very strong spine on the third caudal segment, nor the peculiar flattened spine of the carapace, behind the rostrum, has been represented in the figure given in

Milne-Edwards' work. On the other hand, this figure shows distinctly another feature, very characteristic of thepresent species, and not found, so far as I know, in any other form, viz., the peculiar shape of the two anterior pairs of caudal epimera. Moreover, in several other respects, for example, in the form of the maxillæ, the present animal agrees perfectly with Milne-Edwards' species, and hence I cannot but regard them as identical.

Description.—Most of the specimens collected are rather small, and apparently not yet full grown; but there is in the collection one specimen—a female—much larger than the others, and measuring 24 mm. in length. This example, which, I believe, has attained its full size, is represented in Pl. XVII. fig. 1, whereas the anatomical figures were prepared from one of the smaller specimens.

The form of the body (see fig. 1) is rather slender and somewhat compressed, with the tail, in all the specimens, exhibiting a marked bend in the middle, the three posterior segments being more or less deflexed, forming an obtuse angle with the anterior ones.

The carapace is rather deep in its posterior part, and exhibits on either side two strong and rather distant denticles projecting from the inferior margins, the anterior placed just above the point of insertion of the maxillipeds, the posterior above the base of the penultimate pair of legs. The anterior part of the carapace is much narrower than the posterior, and juts out as a sharp-pointed rostral projection, reaching beyond the middle of the basal joint of the antennulæ. Immediately beneath the base of this projection occurs a very minute denticle, and on the dorsal face, a little behind the rostrum, is seen a rather strong and somewhat flattened spine, pointing straight forwards.

The caudal segments are powerfully developed, and provided with rather large epimera. Of these, the two anterior pairs curve forwards, whereas the three posterior ones are directed obliquely backwards, having the posterior angle somewhat produced. The first pair of epimera are much the largest, and exhibit a rather peculiar form, being, as it were, divided into two acute and anterior curving lappets, the posterior of which is the larger and provided with a small secondary tooth at the inferior margin; the anterior lappet would seem to be partly overlapped by the hinder margin of the carapace. The four posterior segments project at the end, above, as well-marked acute spines, pointing backwards, of which that of the third segment is much the largest. The last segment is rather elongate, with the preanal spine distinctly developed, and armed at the base with a small secondary denticle.

The eyes (see fig. 2) are very large and protruding, pyriform, with the cornea considerably expanded.

The antennular peduncle (fig. 5) is comparatively slender, and almost cylindrical in form, with the basal joint about as long as the two others taken together. It exhibits above two very narrow lanceolate lappets, the one extending from the end of the basal joint, the other originating from the second joint. Moreover, the outer corner of the basal joint is drawn out to a strong forward-pointing spine.

The antennal scale (see fig. 6) projects but very slightly beyond the second joint of the antennular peduncle, and exhibits an oblong-linear form, with the apex narrowly rounded and the outer corner jutting out as a small but distinct dentiform projection. The basal spine is very narrow and quite smooth, and the basal part of the flagellum slender, with the two outer joints equal in length.

The anterior and posterior lips (figs. 7, 8) differ but slightly in structure from those of *Euphausia*, nor do the mandibles (fig. 9) show any characteristic feature, their palp being relatively small, with the last joint oblong in form.

The first pair of maxillæ (fig. 10) are more particularly distinguished by the unusually small size of the exognath, which for the rest exhibits the usual structure.

The second pair of maxillæ (fig. 11) have comparatively a slight development, with the exognath almost obsolete and the terminal joint ovate.

The general structure of the maxillipeds (fig. 12) and of the five anterior pairs of legs (figs. 13–15) agrees very nearly with that in *Euphausia*. On the other hand, the two last pairs exhibit very marked differences.

The penultimate pair of legs (fig. 16), which in *Euphausia* are quite rudimentary, are developed precisely as the preceding pairs, exhibiting, as they do, the full number of endopodal joints, together with a fully developed exopod. In the present species, this pair, however, is somewhat smaller than the preceding, having the meral joint scarcely longer than the ischial, and the terminal part (three last articulations) much shorter than the meral joint.

The last pair of legs (see figs. 17, 17*a*) want every trace of an endopod, but have the exopod in every respect normally developed.

The gills (figs. 17, 20–25) exhibit certain well marked differences in structure as compared with those in *Euphausia*. With the exception of the simple epipodal lobes, which in this genus, as in *Euphausia*, are affixed to the maxillipeds (see figs. 12, 19), and, in a strict sense, correspond to the true branchiæ, all of them exhibit a secondary branch, springing from the main stem at the base interiorly, and backwards gradually becoming more developed. On the gills belonging to the two first pairs of legs (figs. 20, 21) this branch, in the specimen dissected, was quite simple, and in appearance similar to that of the gill-lobules arising from the outer edge of the curved stem. On the succeeding pair (fig. 22) the branch was considerably larger, and exhibited two short lateral lobes on either side. That of the fourth pair of gills (fig. 23) had three well-developed lobes on either side, besides a smaller one at the base. On the fifth pair of gills (fig. 24), too, three bipartite lobes have made their appearance at the base of the branch, in addition to the six simple ones; and on the sixth (penultimate) pair (fig. 25) two of these basal lobes had assumed a structure similar to the main stem (or outer branch), being fringed along one of the edges with a row of well-developed gill-lobules. The last pair of gills (see fig. 17) are much larger than any of the preceding, and consist of two principal stems pointing in

opposite directions, both of which, but more particularly the outer one, are furnished with numerous secondary branches beset with regular rows of gill-lobules. It should, however, be noted, that the specimen submitted to dissection was not yet full grown, and accordingly the gills here figured may be strictly somewhat less complex than in adult animals.

The caudal limbs, or pleopoda (fig. 18), do not differ in their structure from those in other Euphausiidæ.

The telson (see fig. 3) exhibits the usual slender form, tapering gradually toward the apex, which is much produced and drawn out to a very acute point. On examining this point under a high magnifying power, it is found to be armed on either side with two very small secondary teeth (see fig. 3*a*). Moreover, on the dorsal face of the telson four pairs of small denticles occur, disposed at regular intervals. The subapical spines project but very slightly beyond the tip of the telson, and are quite smooth.

The uropoda (*ibid.*) are shorter than the telson, and have the inner plate a trifle longer, but much narrower than the outer.

The luminous globules agree in every respect, as to number, arrangement, and structure, with those of the genus *Euphausia*.

Habitat.—The specimens of this form collected during the Expedition were taken at the surface of the sea in two different localities :—

Date.	Locality.
August 11 to 12, 1874.	Pacific, off Kandavu, Fiji Islands.
August 25, 1874.	West Pacific, Api to Cape York.

Exclusive of these specimens having the aspect peculiar to the adult animal, the characteristic larval form of this species (to be described further on) has been met with in many other localities, showing the distribution of the species to be rather extensive. I annex a list of localities :—

Date.	Locality.
August 23, 1873.	Tropical Atlantic (Station 104).
January 9, 1875.	Off Luzon, Philippine Islands.
February 6, 1875.	Off Mindanao, Celebes Sea.
February 1875.	West Pacific, north of New Guinea.
August 24, 1875.	Pacific, 400 miles south of Hawaii, Sandwich Islands.
August 30, 1875.	Tropical part of Pacific.
September 12, 1875.	Tropical part of Pacific.
March 21, 1876.	South Atlantic (Station 338).
April 6, 1876.	Tropical part of Atlantic.
May 12, 1876.	North Atlantic.

The specimen examined by Milne-Edwards—a full-grown female—came from the Atlantic. Hence the species would seem to inhabit the tropical regions of the Atlantic and Pacific Oceans, sometimes, however, occurring to the north and south of the tropical zone.

26. *Thysanopoda obtusifrons*, G. O. Sars (Pl. XVIII. figs. 1–14).

Thysanopoda obtusifrons, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 25.

Specific Characters.—Form of body rather stout, not very much compressed. Carapace without lateral denticles or dorsal crest, frontal part slightly produced, but obtusely rounded, not forming any distinct rostral projection. Caudal segments smooth above, with epimera of moderate size, none anteriorly curved, the three middle pairs slightly sinuate at the inferior edge. Last segment longer than preceding; preanal spine obsolete. Eyes very small. Antennular peduncle remarkably strong, with rather a large and densely hispid lappet projecting from basal joint above, and overlapping base of second joint. Antennal scale broad, ovate, with apex rounded and outer corner unarmed; basal portion of flagellum very strong and massive. Terminal joint of first pair of maxillæ exceedingly narrow, that of second, on the contrary, very large and broad. Penultimate pair of legs but very little shorter than preceding, with meral joint very elongate. Outer branch of anterior pairs of gills exceedingly small. Telson having above two parallel serrate keels, apex bluntly lanceolate, subapical spines strong and diverging. Inner plate of uropoda shorter than outer. Length reaching 23 mm.

Remarks.—The present form, although differing in its general form very appreciably from the typical species, should unquestionably be regarded as a true *Thysanopoda*, agreeing, as it does, comparatively closely in all the essential anatomical features adduced as characteristic of that generic type.

Description.—Only three specimens of this form were secured, one of which I saw fit to sacrifice for dissection, with the object of determining the generic relationship of the species. The largest of the specimens measures 23 mm. in length.

The form of the body (see Pl. XVIII. fig. 1) would appear to be rather stout, and not compressed by far to the same extent as in the preceding species, both the carapace and the tail occurring broadly rounded above.

The carapace does not exhibit any trace of lateral denticles, the inferior margin being quite smooth and slightly incurved in its anterior part. A very slight keel occurs above on the anterior part, but no trace of any cervical impression can be detected. The frontal part projects somewhat in the middle above the bases of the eyes, without, however, forming any true rostrum, the end of the projection being obtusely rounded off (see fig. 2).

The caudal segments are quite smooth above, and have the epimera of moderate size

and of the usual form, none of them exhibiting a peculiar development. The three middle pairs are slightly sinuate at the inferior edge, whereas the last pair have a rounded triangular form, with the posterior angle produced. The last segment is somewhat elongate, without any distinct preanal spine.

The eyes (see fig. 2) are comparatively rather small, and do not project at all toward the sides, their pedicle being very short, and the cornea but slightly expanded.

The antennular peduncle (fig. 4) is very powerfully developed, with the two outer articulations unusually stout and cylindrical in form. The basal joint appears somewhat flattened, and sends off at the end, above, a broad membranous lobe, overlapping the base of the second joint. This lobe, too, is densely hispid above, and furnished at the inner edge with a row of strong bristles.

The antennal scale (see fig. 5) projects scarcely beyond the second joint of the antennular peduncle, and is rather broad, oval in form, with the apex evenly rounded off, and the outer corner unarmed. The basal spine is very narrow, and quite smooth. The flagellum, in all the specimens, was defective, but may no doubt originally have been very elongate, since the basal part exhibits a most unusually strong and massive appearance.

The mandibular palp (fig. 6) agrees as to form and relative size with that of the typical species, though much more densely beset with bristles, and has, too, the last joint somewhat conically pointed.

The first pair of maxillæ (fig. 7) are in particular distinguished by the remarkably narrow form of the terminal joint, whereas the masticatory lobes, as also the exognath, occur more fully developed than in *Thysanopoda tricuspidata.*

The second pair of maxillæ (fig. 8) have the terminal joint unusually large and broad, as also furnished with numerous bristles, those springing from the inner edge being very slender and elongate.

The maxillipeds do not differ essentially from those in the preceding species.

The first pair of legs have the last joint (fig. 9) remarkably short and compressed, almost triangular in form, and, exclusive of the apical setæ, furnished at the inner edge with a dense row of comparatively short ciliate bristles, the anterior of which is recurved.

The succeeding pairs of legs (see fig. 1) are rather slender, and diminish successively in length backwards.

The penultimate pair of legs (fig. 10) do not appear much shorter than the one preceding them, and have the meral joint comparatively elongate, as also the terminal part more fully developed than in *Thysanopoda tricuspidata.*

The last pair of legs (see fig. 12) do not exhibit, as in the typical species, the slightest trace of an endopod, whereas the exopod is in every respect normally developed.

The five anterior pairs of gills (see fig. 10) have the exterior branch very small, not attaining by far the size of the interior, which is somewhat elongate, and furnished along

both edges with numerous gill-lobules. On the penultimate pair (see fig. 11) the exterior branch is much more developed, and divided into several curving stems. The last pair of gills (fig. 12), finally, agree closely in structure with those in the preceding species, both of the branches being strongly developed, and provided with numerous secondary stems.

The copulatory appendages to the first two pairs of pleopoda in the male (figs. 13, 14) exhibit in their general structure very considerable resemblance to those in the genus *Euphausia*.

The telson (see fig. 3) is very slender, and tapers gradually posteriorly, with the apex, however, not nearly so produced as in *Thysanopoda tricuspidata*, but obtusely lanceolate in form, as also wanting the secondary denticles occurring in that species. On the upper face of the telson occur two parallel longitudinal keels, distinctly serrate throughout almost their whole length. The subapical spines are very strong and divergent, extending far beyond the tip of the telson, and have their inner edge sharpened but quite smooth.

The uropoda (*ibid.*) appear scarcely shorter than the telson, and have the outer plate both broader and longer than the inner.

The colour, according to a sketch, apparently of this species, by Sir. J. D. Hooker, is light brown. One of the Challenger specimens has here and there partly retained this tint, the posterior part of the tail, for example, exhibiting numerous dark brown pigment-spots (see fig. 1).

Habitat.—The Challenger specimens were collected in the two following localities :—

Date.	Locality.
?	Pacific, one specimen, treated with carmine.
October 14, 1875.	South Pacific, from tow-net attached to the trawl, two specimens (one dissected).

The distribution of the species is therefore, so far as yet known, apparently restricted to the Pacific Ocean.

27. *Thysanopoda cristata*, G. O. Sars (Pl. XVIII. figs. 15–20).

Thysanopoda cristata, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 26.

Specific Characters.—Body rather compressed. Carapace without lateral denticles; anterior part with a well-marked crest along the middle; rostral projection rather strong, cultrate, with a small denticle above near the tip. Caudal epimera comparatively large; fourth and fifth segments with a small dorsal spine; last segment scarcely longer than

preceding, preanal spine obsolete. Eyes very short. Antennular peduncle without distinct dorsal lappets, but exhibiting an unusually strong seta that issues from inner corner of last joint. Antennal scale oval in form, with rounded apex and outer corner jutting out as a well-defined tooth. Telson with six pairs of dorsal denticles, apex but slightly produced, subapical spines smooth. Inner plate of uropoda shorter than outer. Length 55 mm.

Remarks.—There cannot, I think, be any doubt whatever as to this form also being a true *Thysanopoda*, though the oral parts and gills could not in the single specimen taken be submitted to a close examination. The species may be readily distinguished from either of the two preceding ones by its strongly compressed body, elevated dorsal crest, and peculiar rostrum.

Description.—Only a single specimen of this species, an adult male, was secured. It has a length of as much as 55 mm., and accordingly ranks among the largest forms of the Euphausiidæ.

The body (see Pl. XVIII. fig. 15) is rather stout, but very much compressed throughout.

The carapace lacks, as in *Thysanopoda obtusifrons*, every trace of lateral denticles, the inferior margins being quite smooth and evenly incurved along the middle. The anterior part has a well-marked and somewhat elevated crest in the middle, and juts out as a distinctly developed rostrum, reaching almost to the end of the basal joint of the antennulæ. The form of the rostrum is also in this species somewhat different from that usually met with in the Euphausiidæ, being somewhat cultrate, with a sharp carina both at the upper and the lower side, the former constituting a continuation of the dorsal crest of the carapace. Its apex is drawn out to a sharp somewhat deflexed point, and a little behind the latter a very small denticle occurs on the upper edge of the rostrum.

The caudal segments are very powerfully developed, with rather large epimera of a slightly irregular form, the three middle ones being, as in *Thysanopoda obtusifrons*, sinuate along the inferior edge. The three anterior segments are quite smooth above, whereas the two succeeding ones exhibit a small spiniform projection in the middle of the posterior margin. The last segment scarcely exceeds in length the preceding, and does not exhibit any trace of a preanal spine.

The eyes (see figs. 15, 16) are very short, almost globular in form, and project but little, if at all, beyond the sides.

The antennular peduncle (see fig. 16) is rather strong, with the anterior border of the basal joint somewhat thickened and densely setose, though not constituting a true lobe, and the outer corner is produced as a spiniform projection. The second joint projects above at the end as a small triangular lappet, overlapping the base of the terminal joint. The latter exhibits at the inner edge, near the tip, a remarkably strong

forward directed seta, which at the first glance may be taken for a third flagellum. The true flagella are exceedingly elongate, nearly equalling the length of the whole body.

The antennal scale (see fig. 16), reaching but slightly beyond the second joint of the antennular peduncle, is rather broad, of an oval form, and obtusely rounded at the tip, with the outer corner jutting out as a well marked though rather small denticle. The flagellum is very elongate, even slightly exceeding in length those on the antennulæ.

The oral parts of course could not be accurately examined in the single specimen preserved.

The maxillipeds and legs, as also the gills, would not appear to differ essentially from those parts in *Thysanopoda obtusifrons*.

The copulatory appendages to the first pair of pleopoda (fig. 19) are somewhat similar to those in the last species. A few minor differences may, however, be found in the structural details. Thus, both the hook-shaped processes of the outer part are quite simple, subulate, whereas in *Thysanopoda obtusifrons* one is slightly dilated at the tip and the other distinctly angulate at the base. The appendages to the second pair (fig. 20) agree almost exactly with those in the above mentioned species.

The telson (see fig. 17) is of moderate length, tapering uniformly towards the apex, which is acutely pointed. The subapical spines (see fig. 18) are comparatively small and scarcely at all divergent, as also quite smooth. Moreover, on the dorsal face of the telson may be seen about six pairs of small denticles.

The uropoda (see fig. 17), when extended backward, reach a little beyond the tip of the telson, and exhibit between the plates a relation similar to that in *Thysanopoda obtusifrons*, the inner being appreciably shorter than the outer.

Habitat.—The only specimen secured was brought up in the trawl from a considerable depth in the Celebes Sea, south of Mindanao, Philippine Islands—Station 213, February 8, 1875; lat. 5° 47′ N., long. 124° 1′ E.; depth, 2050 fathoms; blue mud.

In all probability the specimen in question did not actually enter the trawl at that enormous depth, but most likely was taken by the net during its upward passage from some intermediate stratum of the sea.

28. *Thysanopoda microphthalma*, n. sp. (Woodcut, Fig. 3).

Specific Characters.—Form of body comparatively slender. Carapace with a single lateral denticle, projecting from the inferior margin far behind the middle; anterior part very slightly keeled above, and jutting forth as a well-marked acuminate rostrum. Caudal segments smooth above, with epimera not very large. Last segment longer than preceding; preanal spine distinct unguiform. Eyes exceedingly small, rounded. Antennular peduncle strong, with a densely hispid lobe projecting from the basal joint

above and drawn out to a strong spine. Antennal scale oblong-ovate; apex rounded, with no denticle on outer corner. Penultimate pair of legs much shorter than preceding. Telson with numerous small dorsal denticles. Inner plate of uropoda scarcely shorter than outer. Length 15 mm.

Remarks.—Of this form, not recorded in my Preliminary Notices, the collection contains a single, apparently young, specimen, stained with carmine and mounted on a glass slide. It is somewhat defective, wanting, as it does, several of the legs, as also the outer part of the telson. Quite recently I have, however, had an opportunity of examining another specimen of the same species, in an excellent state of preservation, brought home by the Norwegian traveller, Mr. Lumholtz. I have thus been enabled to make out the distinctive characters with greater precision, and at the same time been fully convinced that the form in question constitutes a new and well-marked species of the genus

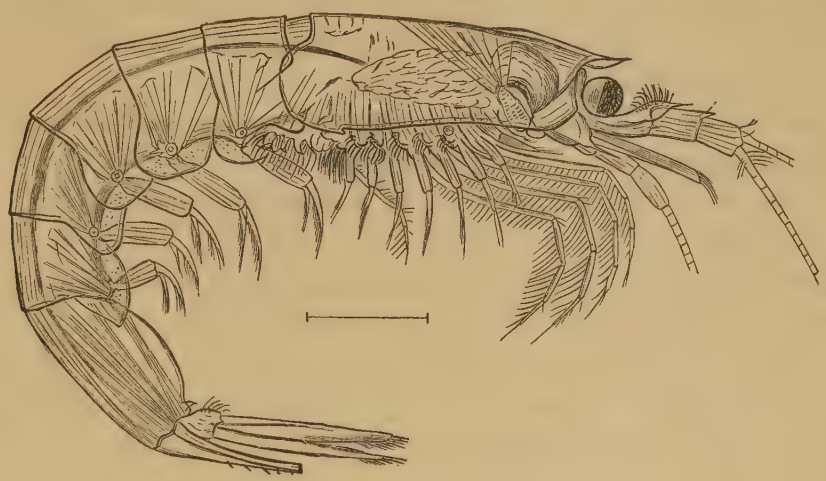

Fig. 3. *Thysanopodo microphthalma*, n. sp.

Thysanopoda. Owing to the species not being figured in the plates, I have subjoined a woodcut, exhibiting the Challenger specimen from the right side. This form is closely allied to *Thysanopoda obtusifrons*, from which, however, it may be at once distinguished by the sharply pointed rostrum and the well-marked lateral denticle of the carapace. Moreover, its specific designation is derived from the remarkably small size of the eyes.

Description.—The Challenger specimen has a length of 15 mm. That secured by Mr. Lumholtz, which appears full grown, is considerably larger, measuring about 22 mm. in length. Both specimens are females.

The form of the body (Fig. 3) appears somewhat more slender than in any of the preceding species.

The carapace has on either side a well-marked lateral denticle, extending from the inferior margins far behind the middle, or, more precisely, just above the base of the penultimate pair of legs. Its anterior part is very slightly keeled above, and projects

as a well defined, though rather short, acutely pointed rostrum, somewhat compressed in its outer part.

The caudal segments in the Challenger specimen would appear to be quite smooth above, whereas in that obtained by Mr. Lumholtz a distinct, though very small, dentiform process is seen projecting above from the end of the third segment. The epimera are of the usual appearance, rather small in the Challenger specimen, a trifle larger in the other. The last segment is somewhat longer than the preceding, and exhibits at the end, inferiorly, a well-marked unguiform preanal spine.

The eyes are exceedingly small, more so even than in *Thysanopoda obtusifrons*, and of a rounded form, with the cornea occupying about the outer half of the eye.

The antennular peduncle is rather strong, and not unlike that of *Thysanopoda obtusifrons* in form, having, as in that species, a densely hispid lobe projecting above from the end of the basal joint. This lobe, however, has in the present species the outer corner drawn out to a strong spiniform projection, and, moreover, another but much smaller lobe occurs extending above from the second joint.

The antennal scale would appear to have much the same form as that in *Thysanopoda obtusifrons*, though perhaps a trifle more oblong.

As regards the oral parts and the gills, no detailed examination could be made, for want of sufficient material.

The legs present apparently a close resemblance to those in *Thysanopoda obtusifrons*, saving, however, that the penultimate pair is relatively somewhat shorter.

As stated above, the outer part of the telson was broken off in the Challenger specimen. In the other (Mr. Lumholtz's) it is of moderate size, and furnished with about nine pairs of small dorsal denticles, exclusive of the subapical spines, which are somewhat slender and smooth.

The uropoda, when extended posteriorly, reach a little beyond the tip of the telson, and have the inner plate but very little shorter than the outer.

Habitat.—The Challenger specimen was taken at the surface of the sea, in the North Atlantic, May 3, 1876; lat. 26° 21′ N., long. 33° 37′ W.

The specimen procured by Mr. Lumholtz was likewise obtained with the surface-net, but in the tropical region of the Atlantic, lat. 7° N., long. 23° W.

The distribution of the species as yet known, would accordingly appear restricted to the Atlantic Ocean.

Genus. 3. *Bentheuphausia*, n. gen.

Generic Characters.—Body scarcely compressed. Eyes imperfectly developed. Flagella of both pairs of antennæ greatly elongate. Antennular peduncle remarkably short and stout. Oral parts very peculiar in structure. Mandibles strongly developed,

with greatly expanded masticatory part, cutting edge but slightly dentate; palp very large. First pair of maxillæ with anterior masticatory lobe strongly projecting and coarsely spinous along the edge; palp small but distinctly tri-articulate; exognath drawn out posteriorly as a narrow lappet. Second pair of maxillæ with a prodigiously developed palp, consisting of three distinctly defined lamellar articulations. Maxillipeds rather strong, pediform. All of the legs distinctly developed, with the joints more or less lamellar, expanded; last pair rather short, but having both endopod and exopod well defined and of a structure similar to that in the preceding pairs. Gills very fully developed, the three posterior pairs exceedingly complex; last pair by far the largest. Telson comparatively short. Uropoda with the plates remarkably broad, outer one distinctly jointed near the apex. Luminous globules apparently wanting.

Remarks.—This genus I have seen fit to establish for the reception of the anomalous form recorded by myself at an earlier date as *Thysanopoda amblyops*, and first examined from a defective specimen only. Having since found in the collection another somewhat broken specimen, I had the means of making a more detailed anatomical investigation and thus became convinced, that the form in question constitutes the type of a specially distinct and very peculiar genus. More particularly the oral parts exhibit a most remarkable structure, totally different from that in any other known genus of Euphausidians. Moreover, the gills present certain well-marked peculiarities of structure; and finally, the genus is the only one in which all the legs, even the last pair, are fully developed. The imperfect development of the eyes would seem to support the assumption of the present form being a true deep-sea animal; and hence I have deemed it advisable to designate the genus accordingly.

29. *Bentheuphausia amblyops*, G. O. Sars. (Pl. XIX., Woodcut, Fig. 4).

Thysanopoda (?) *amblyops*, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 27.

Specific Characters.—Body almost cylindrical in form. Carapace without any lateral denticles, anterior part very slightly keeled above, with frontal margin produced in the middle into an acute angle. Caudal segments smooth above, with rather small, rounded epimera. Last segment somewhat longer than preceding, preanal spine obsolete. Eyes very small, with pedicle narrow, cylindrical, and slightly expanded at the end above, cornea exceedingly minute, with light pigment and imperfectly developed visual elements. Antennular peduncle short and thick, somewhat flattened at base, with an acute lobe projecting from basal joint above. Antennal scale almost reaching extremity of antennular peduncle, oblong-ovate in form, apex obliquely rounded, outer corner scarcely at all projecting. Telson flattened, tapering, with two pairs of small dorsal denticles; apex pointed, subapical spines smooth. Uropoda scarcely, if at all, longer than telson,

with outer plates the larger, and exhibiting exteriorly a small tooth somewhat remote from the apex. Length reaching 48 mm.

Remarks.—Among the drawings executed during the expedition by the late Dr. v. Willemoes-Suhm, there is one that undoubtedly represents this species, and as the specimen from which the drawing was executed, according to the subjoined notes, must have been very considerably larger than the ones examined by myself, and had, too, all its legs uninjured, I have seen fit to reproduce the figure in the annexed cut. In his manuscript notes, the late lamented naturalist has only recorded this interesting form as *Thysanopoda* sp. ?—Unfortunately, the specimen has been lost, and hence the following description has been worked out in all essential particulars from the smaller ones, examined by myself.

Description.—The length of the specimen represented in Pl. XIX. fig. 1, is 20 mm.,

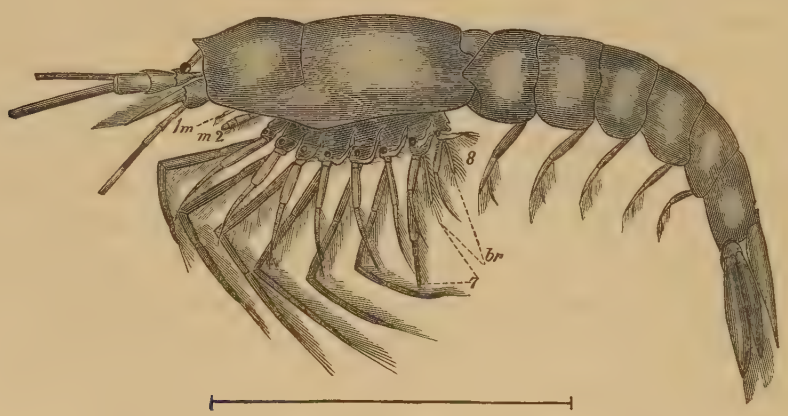

Fig. 4. *Bentheuphausia amblyops*, G. O. Sars, n. gen.

and that selected for anatomical investigation had very nearly the same size. The specimen examined by the late Dr. v. Willemoes-Suhm, and figured in the accompanying cut, was much larger, measuring, as stated by that author, not less than 48 mm. in length. All three specimens were females.

The form of the body (see Pl. XIX. fig. 1, and accompanying cut) is somewhat slender, and differs from that in most other Euphausiidæ in being very little, if at all, compressed, but nearly cylindrical throughout.

The carapace has not a trace of lateral denticles, the inferior margins being quite smooth and almost straight. The anterior part is defined posteriorly by a slight cervical impression, and exhibits above, in the middle, a low keel, obsolete anteriorly. The frontal margin projects in the middle as an acute angle extending above the bases of the eyes, without, however, forming any true rostrum. The antero-lateral corners of the carapace are obtusely truncate. Posteriorly, the carapace forms a deep and narrow emargination, leaving, as usual, the dorsal part of the last segment of the trunk uncovered.

The caudal segments are quite smooth above, and provided with comparatively rather small, rounded epimera. The last segment somewhat exceeds in length the preceding, and does not exhibit any trace of a preanal spine.

The eyes (see figs. 2 and 4) are remarkably small, incompletely developed, and do not in the least project beyond the sides of the carapace. The pedicle is narrow cylindrical, but expands at the end, above, as a knob-like prominence. The cornea occupies only a small part of the eye, and is distinguished by its light, whitish pigment, as also by the surface exhibiting no true corneal facets or other visual elements, but merely an indistinct and irregular areolation.

The antennular peduncle (figs. 5, 6) is remarkably short and thick, with the basal joint somewhat flattened, and about as large as the other two taken together; moreover, it juts out above at the end, somewhat interiorly, as a pointed process, bearing on the inner edge a row of stiff incurved bristles (see fig. 6). The flagella were broken off in the specimens examined, but would seem to have been rather elongate, judging from the thickness of the still remaining basal part, more especially of the outer flagellum.

The antennal scale (fig. 7) about equals in length the antennular peduncle, and exhibits an oblong-ovate form, the apex being broadly rounded and somewhat oblique, with the outer corner not in the least projecting, and armed with a very minute denticle. The basal spine is likewise very small, nearly obsolete, whereas the peduncle of the flagellum is very strong, reaching to the tip of the scale. The terminal part of the flagellum was broken off in the specimens examined, but may no doubt have been very elongate.

The anterior lip (fig. 8) is comparatively large, and has the lateral corners a good deal projecting; for the rest, it shows the stucture characteristic of the family.

This will also apply to the posterior lip (fig. 9), the terminal lobes of which have the usual triangular form.

The mandibles (figs. 10, 11) are very strong, with the masticatory part considerably expanded, securiform, and scooped out a little anteriorly. The cutting edge is sharpened and exhibits a small number only of scattered teeth, somewhat differently arranged on the two mandibles (see fig. 10). The palp is comparatively very large, fully equalling the mandible itself in length. Of its joints, the middle one is by far the largest, and rather broad, as also fringed along both edges with strong ciliated bristles. The last joint is oblong, and furnished along the inner edge with a double series of bristles.

The maxillæ (figs. 12, 13) exhibit a structure very different from that observed in any hitherto known form of Euphausiidæ, and would thus fully warrant the generic distinctness of the present form.

The first pair of maxillæ (fig. 12) have the two masticatory lobes very unequally developed, the posterior lobe forming merely a broad, lamellar expansion of the basal part, fringed along the edge with a dense row of plumose setæ, whereas the anterior lobe projects very considerably, and is dilated into a somewhat securiform apex, which is

armed along the edge with a rather large number of strong spines, unequal in size. The palp, unlike that of other Euphausiidæ, is distinctly triarticulate, though very small, the middle joint being the largest, and furnished along the inner edge with a row of strong bristles, whereas the basal and terminal joints are quite unarmed. The exognath, finally, constitutes an oval plate, without any bristles, and of a peculiar almost spongy structure. Moreover, it is specially distinguished by the posterior part being drawn out into a narrow, finely ciliate, lobe.

The second pair of maxillæ (fig. 13) exhibit a perhaps still more anomalous aspect, owing to the prodigious development of the palp. The latter, constituting, as it does, in all other known Euphausiidæ, only a single lamellar joint, occurs here as a large trunk, fully equal in length to the remaining part of the maxilla, and composed of three well-defined lamellar expanded articulations, giving to the maxilla, as it were, a pediform appearance. Of the joints, the first is by far the largest and very broad, oval in form, and fringed along the inner edge with numerous long curving plumose setæ. The two outer joints rapidly diminish in size, and are likewise provided with strong plumose setæ along the inner edge, as also a few much shorter ones at the outer. The remaining part of the maxilla exhibits, on the whole, a normal appearance, having interiorly four densely setose masticatory lobes, and exteriorly a small lamellar exognath edged with short ciliate bristles.

The maxillipeds (fig. 14) exhibit the usual pediform structure, having, however, the proximal part remarkably robust, with the joints much appressed, whereas the distal part, consisting of the outer three joints, would seem to be somewhat slender and very movably jointed to the former. The meral joint, by far the largest, slightly exceeds in length the distal part. All the joints are provided along the inner edge with a number of slender scattered bristles. The masticatory lobe, issuing internally from the coxal joint, is found on closer examination (see fig. 15) to consist of two superposed lappets, both edged with strong curving setæ. The exopodite is rather powerfully developed, reaching beyond the middle of the meral joint. The epipodite, finally, constitutes a small membranous plate, projecting both anteriorly and posteriorly as a rounded lobe.

All the legs, save the last pair, had been broken off in the specimens I examined, only their basal parts along with the gills and exopods being left. In the specimen, however, examined by the late Dr. v. Willemoes-Suhm, they had suffered no mutilation and were fully represented in the figure drawn by that naturalist, of which the annexed cut is an accurate copy. As seen from the figure, they are rather elongate, but relatively coarser in structure, than in other Euphausiidæ, the joints being much appressed and densely setose.

The last pair of legs (fig. 18) are much smaller than the rest, and in the specimens examined were almost entirely hidden between the gills, so as readily to escape attention. Hence, too, they came to be quite overlooked by myself as also by the late Dr. v.

Willemoes-Suhm, who simply states in his manuscript notes, that they occurred as a mere rudiment. On dissecting one of the specimens in the collection, I found them, however, developed precisely as the rest, both the exopod and endopod being well defined, the latter as a distinctly articulate stem, differing merely in having the terminal part very small and composed of only two articulations.

The gills (see figs. 16–24), although on the whole presenting the structure and arrangement characteristic of the family, yet exhibit certain striking peculiarities. They increase successively in size posteriorly, and become, as they do so, more complex in structure, the three hindmost pairs being richly arborescent. In no other form of Euphausiidæ does the homology of the gills to the epipod admit of being better demonstrated than in the present animal. For in the anterior pair (see figs. 16 and 19) the epipod-plate retains precisely the original aspect it has in the maxillipeds, whereas the true branchial part is found to be merely an out-growth from the exterior face of this plate, in the form of a curved stem fringed along its posterior edge with a regular series of gill-lobules of the usual structure. In the second pair (fig. 20) the interior extremity of the epipod-plate has become somewhat produced, and from its apex a single minute gill-lobule has taken origin, whereas the outer gill-stem remains unaltered. In the third pair (fig. 21) the inner part of the epipod-plate has taken a still more striking gill-like aspect, several other gill-lobules having made their appearance on its edge; and in the following pair, this would appear characteristic to a still greater extent. Finally, in the fifth and sixth pairs (figs. 22, 23), the inner part of the epipod-plate has been so greatly modified as to assume the aspect of the principal part of the gill, furnished, as it is, with several spirally arranged gill-stems, each subdivided into numerous lobules. Yet in all those pairs, the outer part of the epipod-plate has remained almost unchanged, forming a simple rounded lobe, of a peculiar, as it were spongy structure, and projecting above the true gills (see fig. 1). The last pair of gills (see figs. 18–24) are very large, and, as usual, exhibit two principal diametrically diverging sections, both of which are divided into numerous secondary branches, partly spiral in arrangement, and all of them furnished at one of their edges with a regular series of gill-lobules.

The pleopoda (fig. 25) do not exhibit any marked peculiarities of structure.

The telson (see fig. 3) is relatively less produced than in other Euphausidians, and scarcely longer than the last segment. Moreover, it is somewhat flattened throughout, tapering gradually toward the apex, which is sharply pointed. The subapical spines are rather slender, reaching far beyond the tip of the telson, and perfectly smooth. On the dorsal face of the telson occur in addition two pairs of very small denticles.

The uropoda (*ibid.*) scarcely extend beyond the telson, and have both plates comparatively broad and lamellar. The inner plate, which is the shorter, is lanceolate and fringed all round with plumose setæ. The outer plate is oblong in form, and exhibits, contrary to what is the case in other Euphausiidæ, in its outer part a distinct

transverse suture, marking off a linguiform terminal joint, as in *Gnathophausia* or *Eucopia;* its outer edge is quite straight and naked, terminating in a small dentiform projection, whence the above mentioned suture runs inward.

Of luminous globules I failed on dissection to detect any trace whatever. True, the late Dr. v. Willemoes-Suhm observes in his manuscript notes having indistinctly been able to trace a number of accessory eyes (Nebenaugen) on the anterior division of the body, and has also represented such organs in his drawing (see woodcut, fig. 4, p. 110) as occurring at the bases of all the legs. But, to judge from the place assigned, I feel convinced that he has obviously taken for accessory eyes the incrassated outer lobe of the epipod-plates, these, perhaps, being more vividly coloured than the rest.

Colour.—According to the manuscript notes of the late Dr. v. Willemoes-Suhm, the whole body of the animal in a fresh state, unlike what occurs in other Euphausiidæ, is quite opaque and of a similar vivid-red colour to that in most other true deep-sea Crustaceans.

Habitat.—The two specimens examined by myself were taken in the following localities:—

October 1873, off Tristan da Cunha; depth, 1000 fathoms.

Station 107, August 26, 1873, Tropical Atlantic; lat. 1° 22′ N., long. 26° 36′ W.; depth, 1500 fathoms; Globigerina ooze; bottom temperature, 37°·9.

The specimen examined by the late Dr. v. Willemoes-Suhm was obtained south of Australia, in the following locality:—

Station 158, March 7, 1874; lat. 50° 1′ S., long. 123° 4′ E.; depth, 1800 fathoms; Globigerina ooze; bottom temperature, 33°·5.

As regards distribution, this form, therefore, would appear to inhabit the abysses of the Atlantic and Southern Oceans.

Genus 4. *Nyctiphanes*, G. O. Sars, 1883.

Nyctiphanes, G. O. Sars, Preliminary Notices on the Challenger Shizopoda.

Generic Characters.—General appearance as in *Euphausia.* Flagella of both pairs of antennæ greatly elongate. Antennular peduncle elongate, cylindrical, stronger in male than in female, basal joint provided above at extremity with a reflexed membranous leaflet. Oral parts and anterior legs very nearly as in *Euphausia.* Penultimate pair of legs distinctly developed, but differing from the rest in the endopod consisting of two elongate joints only. Last pair of legs quite rudimentary, forming a minute non-articulate and flexuose stem, without any bristles. Last pair of gills rather complex, remaining pairs comparatively simple, main stem expanded at extremity and drawn out as two diverging points. Ovisac double. Luminous globules as in *Euphausia.*

Remarks.—This genus is mainly characterised by the peculiar reflexed leaflet on the

antennular peduncle, as also by the structure of the two hindmost pairs of legs, both of which are rather dissimilar, as compared with those in other Euphausiidæ. Moreover, the structure of the gills is somewhat different. Finally, the genus is highly distinguished by the presence in the female of a double ovisac. Besides the new species described below, the northern form, *Thysanopoda norvegica*, M. Sars, which, perhaps, is identical with *Thysanopoda couchii* of Bell, belongs to this genus. The generic name proposed here is a translation into Greek of the appellation "*Noctiluca*," adapted by W. Thompson for a form of this family, but preoccupied in zoology for a Protozoon.

30. *Nyctiphanes australis*, G. O. Sars (Pl. XX.; Pl. XXI. figs. 1–7).

Nyctiphanes australis, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 28.

Specific Characters.—Form of body rather slender. Carapace without any lateral denticles, anterior part distinctly keeled above; rostral projection very short; frontal margin forming on either side, above the eyes, an obtuse angle. The two anterior caudal segments having the posterior margin slightly produced in the middle; epimera of moderate size, subtriangular, pointing obliquely backward. Last segment not longer than preceding; preanal spine obsolete. Eyes large and protruding, pyriform. Antennular peduncle very elongate, outer corner of basal joint drawn out to a sharp spine, dorsal leaflet comparatively small, with inner corner acute, outer edge entire. Antennal scale not nearly reaching the tip of second joint of antennular peduncle, narrow, sublinear, outer corner produced as a well-marked tooth. Mandibular palp remarkably elongate. Legs very slender, antepenultimate and penultimate pairs in female wanting exopod. Last joint of penultimate pair half as long as preceding joint. Penultimate pair of gills without secondary branch. Telson with obtusely lanceolate apex; subapical spines slender and smooth. Inner plate of uropoda a trifle longer than outer, and reaching tip of telson. Ovisacs conoid, affixed in part to antepenultimate pair of legs. Length reaching 17 mm.

Remarks.—From the northern form, *Nyctiphanes norvegica* (M. Sars), this species is easily distinguished by its more slender form, the absence of lateral denticles on the carapace, the much more elongate antennular peduncle, the form of the dorsal leaflet thereon, and, finally, by a somewhat different relation in size between the two joints of the endopod of the penultimate pair of legs. Moreover, the structure of the gills and the form and arrangement of the ovisacs would seem to be somewhat different in the two species.

Description.—The length of the adult male is about 17 mm., that of the female somewhat less.

The form of the body in both sexes (see Pl. XX. fig. 1; Pl. XXI. fig. 1) is rather slender, but somewhat different as regards the relation in size between the anterior and posterior divisions, the latter being more fully developed in the male (see Pl. XXI. fig. 1), and

about twice as long as the former, whereas in the female (Pl. XX. fig. 1) the difference in length between the two divisions is much less.

The carapace lacks every trace of lateral denticles, the inferior margins being quite smooth and nearly straight. The anterior part is marked off posteriorly by a slight cervical impression, and exhibits above a distinct, though somewhat low keel. The frontal margin juts out in the middle (see Pl. XX. fig. 3; Pl. XXI. fig. 2) as a comparatively short triangular projection, reaching but very little beyond the ocular segment, forming, too, on either side, above the eyes, an obtuse angle. The antero-lateral corners of the carapace constitute a distinctly projecting angle. Posteriorly, the carapace exhibits a rather deep emargination (see Pl. XXI. fig. 3), from which juts on either side a narrow sinus, disrupting the hinder margin.

The caudal segments are all nearly uniform in length, but diminish hindwards successively both in breadth and height. The two foremost have the posterior margin very slightly produced above in the middle, but, in other respects, these segments are quite smooth above. The epimera are of moderate size and somewhat triangular in form, pointing obliquely backward and terminating in an acute angle. The last segment is relatively very short, its length not exceeding that of the preceding, and wants the slighest trace of a preanal spine.

The eyes (see Pl. XX. fig. 2; Pl. XXI. fig. 2) are very large, projecting towards either side, pyriform, with the cornea greatly expanded.

The antennular peduncle is somewhat different in the two sexes. In the female (Pl. XX. figs. 4–6) it is exceedingly slender, and scarcely exceeds half the length of the carapace, whereas in the male (see Pl. XXI. figs. 1, 2) it is much more powerfully developed, attaining almost the whole length of the carapace. The basal joint is somewhat flattened, and projects at the outer corner as a sharp tooth. The dorsal leaflet, springing, above, from the end of this joint, is reflexed, as in the northern species, but comparatively more simple in structure, having only the inner corner acutely produced, whereas the edges are evenly curved and quite smooth. The second joint is very elongate, attaining almost the length of the basal joint, and, in the female, very narrow and perfectly cylindrical in form, whereas in the male (see Pl. XXI. fig. 2) it is much thicker, and exhibits at the inner edge, near the apex, an obtuse prominence that lies in close contact with the corresponding prominence on the opposite side, when the peduncles are extended in their normal position. The last joint is only half as large as the former, and in the male remarkably dilated and somewhat curved. The flagella are very elongate, and composed of numerous short articulations.

The antennal scale (see Pl. XX. fig. 7) is comparatively small, not nearly reaching the end of the second joint of the antennular peduncle, and exhibits a rather narrow, nearly linear form, tapering slightly, however, toward the apex, which is narrowly truncate, with the outer corner produced as a well-defined tooth. The basal spine is very

small and quite smooth. The basal part of the flagellum is rather elongate, in the female about equalling the length of the scale, in the male (see Pl. XXI. fig. 4) considerably projecting beyond its apex, and having the last joint remarkably large and tumid.

The anterior and posterior lips (Pl. XX. figs. 8, 9) do not exhibit any marked peculiarities of structure.

The mandibles (fig. 10) are comparatively powerful, with the cutting edge (see fig. 11) divided, as usual, into several sharp teeth, and exhibiting besides a well-marked molar protuberance. The palp (see fig. 10) is remarkably slender and elongate, exceeding even the body of the mandible in length, and has the terminal joint nearly as long as the medial, as also somewhat expanded towards the tip, and armed along the inner edge with a row of ciliated bristles, which at the apex assume the character of strong curved spines.

The first pair of maxillæ (fig. 12) have the terminal joint, or palp, rather small and narrow, whereas the exognath is very large and oval in form, with only a pair of minute bristles at the anterior extremity.

The second pair of maxillæ (fig. 13) exhibit the usual structure, with the terminal joint approximately triangular in shape.

The maxillipeds (fig. 14) occur, as usual, quite pediform and very slender, with the terminal joint (fig. 14*a*) linear and furnished along the inner edge with a row of small ciliated bristles, besides a few longer setæ. The epipodite forms a very small, narrow, triangular lamella, affixed to the outer side of the coxal joint.

The legs (see Pls. XX., XXI. fig. 1) are exceedingly slender and elongate, as also densely setose, with the ischial joint longest. They increase somewhat in length as far as the third pair, where they gradually diminish a little in size. On the first pair (fig. 15) the terminal joint occurs but very slightly expanded, having, however, the usual bunch of ciliated bristles near the tip (see fig. 15*a*). In this pair, as in the three succeeding (see fig. 16), the terminal part, consisting of the three outer articulations, is much longer than the meral joint, whereas in the antepenultimate pair (fig. 17) this part is much reduced in size. On the other hand, in this pair the ischial joint is very elongate, being twice as long as the meral. The penultimate pair of legs (fig. 18) occur entirely without the terminal part, the endopod being composed of only two joints, the last of which (meral) scarcely attains half the length of the preceding. On both of the last mentioned pairs the exopod is wholly wanting in the female, whereas in the male this part occurs distinctly developed (see Pl. XXI. fig. 5). The last pair of legs (Pl. XX. figs. 19, 20) are quite rudimentary, being in greater part completely hidden between the posterior gills; they constitute a small, somewhat flexuose naked stem springing from a somewhat thickened basal part, and exhibiting an exceedingly soft consistence, similar to that of the gill-stems.

The gills increase, as usual, successively in size from before backwards, forming a regular series along the sides of the trunk below the carapace. The six anterior pairs

(see figs. 15–18) are comparatively simple in structure, and perfectly similar in appearance, occurring as single stems expanded at the extremity into two short diverging corners, and having along the hinder edge a regular series of digitiform gill-lobules, diminishing in length towards each extremity. The last pair (fig. 19), on the other hand, are very large and complex, divided as usual into two principal portions pointing in opposite directions, the posterior of which is the larger, and provided with several curved secondary branches, each having along one of its edges a regular series of gill-lobules.

The pleopoda of the female (fig. 21) do not exhibit any essential peculiarities of structure.

The copulatory appendages to the two first pairs of pleopoda in the male (see Pl. XXI. figs. 6, 7) are, on the whole, not so fully developed as in most other Euphausiidæ. Those on the first pair (fig. 6) form a somewhat curved lamella, doubling over the inner plate of the pleopod, and with the inner edge finely serrate. From this lamella, also, proceed two comparatively small processes, the outer of which is mucroniform and highly chitinised, whereas the inner is narrow linguiform, and quite soft. Moreover, a slender incurved spine is seen to spring from a rounded prominence on the outer margin. The appendages of the second pair of pleopoda (fig. 7) constitute merely a slight two-lobed expansion of the inner edge of the principal plate.

The telson (see Pl. XX. fig. 22) exhibits the usual slender form, tapering gradually toward the apex, which is but slightly produced and bluntly lanceolate (see fig. 23). The subapical spines are of moderate length and perfectly smooth. Moreover, two pairs of small denticles occur on the dorsal face of the telson.

The uropoda (see fig. 22) have the inner plate very narrow and a trifle longer than the outer, reaching, when extended posteriorly, to the tip of the telson. The outer plate of each is rather broader, and truncate at the apex, with the outer corner projecting as an acute angle.

Of the female specimens in the collection, two are ovigerous, a condition very rarely met with among preserved specimens of Euphausiidæ. The eggs were deposited in two well-defined ovisacs (see Pl. XX. figs. 1, 2) placed side by side beneath the posterior part of the trunk. These ovisacs do not consist of incubatory lamellæ, as in other Schizopoda, but merely of an exceedingly thin membrane, derived, it would seem, from some glutinous fluid issuing along with the ova and coagulated by the action of the sea-water as a delicate envelope surrounding and keeping the ova together during the embryonal development. In form, the ovisacs are somewhat conical, being broadest posteriorly and gradually tapering forward, where they are connate with the inner half of the ischial joint of the antepenultimate pair of legs, covering too, exteriorly, a considerable part of the succeeding pair. This peculiar arrangement of the ovisacs fully suffices, it would seem, to account for a striking anomaly met with in the present species and mentioned above, viz., the total absence of exopods on the posterior pairs of legs in the females. It is, indeed, evident that these organs would be quite inoperative, and

even actually burdensome to ovigerous animals, as the ovisacs would to a very considerable extent interfere with their free mobility; hence their development in the females is quite arrested in that region, whereas in the male they are retained, as usual, on all the legs, except the last (see Pl. XXI. figs. 1, 5). Of the northern species, *Nyctiphanes couchii*, Bell (= *Nyctiphanes norvegica*, M. Sars ?), an ovigerous specimen has on one occasion only been observed, viz., by Professor Bell, in whose well-known work on the British Stalk-eyed Crustacea, the ovisacs are recorded and figured as two rotund sacs depending freely from the posterior part of the trunk. The form and arrangement of the ovisacs in the two species accordingly exhibit well-marked differences, though agreeing in their being not confluent, as is the case in other forms of Euphausidians.

As regards the luminous apparatus, the number and arrangement of the globules perfectly agrees with that described above in the genus *Euphausia*.

Habitat.—Of the present species rather numerous specimens, besides some few larvæ in a very early stage of development, to be described further on, were collected in three different localities off the Australian coast. All the specimens were taken in the surface-net, and in most instances at night. The localities were as follows :—

Date.	Locality.
April 2, 1874.	Off East Moncœur Island, Bass Strait.
April 3, 1874.	Off Cape Howe, south-eastern coast of Australia.
June 8, 1874.	Off Port Jackson, east coast of Australia.

With respect to distribution, the species would accordingly appear to be wholly confined within the limits of the Australian Seas.

Genus 5. *Thysanoëssa*, Brandt, 1851.

Thysanoëssa, Brandt, Middendorf's sibirische Reise, Zoologie.

Generic Characters.—Body more or less slender, tapering posteriorly. Carapace short, distinctly rostrate, antero-lateral corners produced. Eyes of somewhat irregular form, cornea divided, as it were, into two segments by a transverse constriction. Flagella of both pairs of antennæ very short. Antennular peduncle without any dorsal leaflet, basal joint much flattened, the two other narrow and elongate. Terminal joint of second pair of maxillæ comparatively small, exognaths in both pairs well developed. Maxillipeds slender, not very elongate. First pair of legs very strongly developed, and much longer than the rest, geniculate, meral and carpal joints very elongate and nearly naked, propodal joint compressed, and provided on both edges with strong, spiniform

bristles, terminal joint very small and spinous. Remaining pairs of legs successively diminishing in size. Penultimate pair of legs exceedingly small, endopod bi-articulate, exopod distinct. Last pair of legs quite rudimentary, forming only a small linguiform and setose plate. The three posterior pairs of gills sending off a branch inwards; exterior branch in all as in *Nyctiphanes*. Luminous apparatus of the usual structure.

Remarks.—This genus was established by Brandt for the reception of an Arctic species from the Siberian Sea, *Thysanoëssa longipes*. I have recorded[1] two species from the Norwegian coast, *Thysanoëssa borealis* and *Thysanoëssa tenera*, and in the Challenger collection there are two other species described below. Thus the genus comprises at present five different species. They all agree in the characters stated above, the most striking of which is the strong development of the first pair of legs.

The two Challenger species may be briefly characterised in the following manner:—

Body	comparatively clumsy, with last segment only slightly longer than preceding. Rostrum narrow, lanceolate. First pair of legs exceeding half the length of body. Eyes remarkably large, ...	*T. gregaria*, n. sp.
	very slender, with last segment exceedingly elongate and narrow. Rostrum triangular, broad at base. First pair of legs not nearly attaining half the length of body. Eyes of moderate size, ...	*T. macrura*, n. sp.

31. *Thysanoëssa gregaria*, G. O. Sars (Pl. XXI. figs. 8–17; Pl. XXII.).

Thysanoëssa gregaria, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 29.

Specific Characters.—Form of body rather short and clumsy. Carapace with a well-marked lateral denticle behind the middle of the inferior margin; rostrum produced, straight, narrow lanceolate. Caudal segments smooth above, with slightly angular epimera. Last segment somewhat longer than preceding, preanal spine very large, forming a broad plate, serrate at posterior edge. Eyes remarkably large, irregularly globose, upper part of cornea narrowed. Antennal scale reaching beyond second joint of antennular peduncle, oblong, tapering, apex obliquely rounded, with outer corner projecting. First pair of legs, when extended, exceeding half the length of body, meral joint reaching tip of antennular peduncle. Telson with two pairs of dorsal denticles, apex acuminate; sub-apical spines smooth. Inner plate of uropoda a trifle longer than outer, scarcely reaching tip of telson. Length 18 mm.

Remarks.—This species may at once be distinguished from the three northern forms by its relatively short and clumsy body, as also its remarkably large eyes. Moreover, the peculiar form and strong development of the preanal spine would seem to afford a good specific character.

Description.—The average length of adult females is about 18 mm. The males are, as a rule, somewhat smaller.

[1] Oversigt over Norges Crustaceer, Bd. i., pp. 52, 53, 1882.

The form of the body (see Pl. XXI. figs. 8, 9) appears rather short and clumsy, and slightly compressed. It tapers gradually from before backwards, and has the tail about twice the length of the anterior division.

The carapace is comparatively short, and exhibits on either side a well-marked lateral denticle jutting out from the lower margins somewhat posterior to the middle, or rather, just above the insertion of the antepenultimate pair of legs. Its anterior part is defined posteriorly by a slight cervical impression, and exhibits above a distinct, though not very elevated, keel, continued along the upper face of the rostral projection. The latter (see fig. 12) is rather produced, reaching considerably beyond the middle of the basal joint of the antennulæ, and has a narrow lanceolate form, being somewhat appressed at the sides. In the male this projection (see fig. 17) exhibits a somewhat different aspect, being remarkably constricted at the base and slightly expanded at the apex, which is bluntly lanceolate. The antero-lateral corners of the carapace (see fig. 8) are drawn out to a rather prominent acute-angled lobe, overlapping externally the basal part of the antennæ. The posterior emargination of the carapace is not very deep, and without any lateral sinus.

The caudal segments are quite smooth above, and diminish successively in height posteriorly. The epimera are well developed, and of a somewhat angular form, pointing obliquely backwards. The last segment is a trifle longer than the preceding, and somewhat narrow. The preanal spine (fig. 16) exhibits a rather characteristic appearance, being very broad, lamellar, and with coarse denticles, arranged in a pectinate manner, along the posterior edge.

The eyes (see figs. 10, 11) are very large and thick, irregularly globose, with the pedicle very short, and the cornea greatly expanded. The latter is, as in other species of the genus, somewhat contracted in its upper part, and divided, as it were, into two unequal sections by a slight transverse impression, crossing the cornea a little above the mesial part.

The antennular peduncle (figs. 13, 14) is rather slender, and scarcely exceeds in length half the carapace. The basal joint is about as long as the two others taken together, and very much flattened, with the anterior border somewhat projecting above and densely setose, as also exhibiting, at some distance from the inner corner, a narrow indentation. Its outer corner is drawn out to a dentiform projection, and a little below the inner, two strong plumose setæ are seen to originate. The two outer joints are very narrow, and cylindrical in form, the last a trifle longer than the other. The flagella (see fig. 12) are both exceedingly short, scarcely half as long as the peduncle, and composed of ten to twelve short articulations.

The antennal scale (see fig. 15) is comparatively large, reaching far beyond the second joint of the antennular peduncle. It exhibits a somewhat oblong form, and tapers gradually toward the apex, which is very obliquely rounded, with the outer

corner somewhat projecting, the inner obsolete. The basal spine is comparatively small, and quite smooth. The basal part of the flagellum almost equals the scale in length, and is very slender, with the middle joint longest; the terminal part does not attain the length of the basal, and consists of only eight articulations.

The anterior lip (Pl. XXII. fig. 1) exhibits the usual structure.

The posterior lip (fig. 2) has the terminal lobes of a somewhat rounded form, with a small ledge-like projection at the outer edge.

The mandibles (fig. 3) are rather strong, their masticatory part expanded in the usual manner, the cutting edge (see fig. 5) divided into several acute teeth, and forming also a well-defined molar tubercle. The palp (see figs. 3, 4) is comparatively small, not nearly attaining the length of the body of the mandible, and has the terminal joint lamelliform, as also provided along the inner edge with a dense row of ciliated bristles, the outermost of which has the character of a strong spine.

The first pair of maxillæ (fig. 6) present on the whole a normal appearance, having, however, the exognath somewhat large and expanded.

The second pair of maxillæ (fig. 7) are mainly characterised by the small size and triangular shape of the terminal joint, or palp. The exognath, too, appears more fully developed than in any of the preceding genera, constituting, as it does, a distinctly projecting triangular plate, drawn out anteriorly to a very acute angle, and fringed along the outer edge with a dense row of plumose setæ.

The maxillipeds (fig. 8) are exceedingly slender, though not particularly elongate, scarcely reaching, when extended anteriorly, beyond the antennal scale. Of the joints, the meral is by far the longest, exceeding even in length the three outer ones taken together. The terminal joint (see fig. 9) is relatively very small, and provided with several slender bristles, two of which issue from a ledge-like prominence at the outer edge. The exopodite is remarkably elongated, reaching nearly to the tip of the meral joint, and in size appreciably exceeds the true exopods on the legs. The epipodite, on the other hand, is very small and lobular.

The first pair of legs (fig. 10) are most powerfully developed, and much larger than any of the others, exceeding, as they do, when fully extended, half the length of the whole body. As a rule they exhibit, however, a strong geniculate bend, the terminal part, comprising the three outer joints, being abruptly reflexed, and thus forming with the remaining part a more or less acute angle. The proximal part of the leg generally extending straight forward, reaches nearly to the tip of the antennular peduncle. Of the joints, the meral and carpal are exceedingly elongate and almost naked, as also very movably connected with each other, the meral joint being by far the larger of the two, and tapering somewhat towards the apex. The carpal joint is very slender, and slightly dilated at the extremity, where it has on both edges a few short bristles. The propodal joint is about half as long and linear in form, and exhibits along both edges a regular

series of close upon eight spiniform ciliated setæ, those on the inner edge being the longer. The terminal joint is very small, and armed with about five strong curved spines.

The four succeeding pairs of legs (figs. 11–15) rapidly diminish in length, and are likewise strongly geniculate, but, unlike what is observed in the first pair, exhibit a uniform fringe of delicate bristles along their edges. The terminal joint (see fig. 12) is comparatively short in all of them and of a conical form, whereas the two preceding joints are nearly equal in size.

The penultimate pair of legs (figs. 16, 18) are exceedingly small, and, as a rule, completely hidden between the gills, but nevertheless have both the endopod and exopod well defined; the former, however, consists only of two joints, both of which are fringed with strong ciliate bristles.

The last pair of legs (figs. 17, 19) are quite rudimentary, constituting merely a very small linguiform, setiferous lamella, originating from a thickened basal part, and apparently representing the exopod.

The gills, although approximating in appearance to those in the genus *Nyctiphanes*, nevertheless exhibit certain well-marked differences. The three anterior pairs (see figs. 10, 11, 13, 20) merely constitute, as in that genus, simple stems expanded at the extremity as two short branches, curving in opposite directions and provided along the posterior edge with a regular series of gill-lobules. In the three succeeding pairs (see figs. 14–16, 21–23), however, besides this outer stem, another projects inward, also with gill-lobules, which, however, are somewhat spirally disposed. The last pair of gills (see figs. 17, 24) are, as usual, the largest of all, and exhibit in every respect a normal appearance, the outer division having along its outer edge four curved secondary stems, besides two somewhat smaller ones at the apex.

The spermatophores (fig. 25) are distinctly peduncular, the distal part being expanded into a rounded oval vesicle, whereas the proximal part forms a very narrow flexuose stem or neck.

The pleopoda of the female are of the usual structure, and in the male the two anterior pairs have well developed copulatory appendages. Those of the first pair (see figs. 27, 29) are very strong, consisting of two lamellar portions folded one upon the other, the outer of which projects as two highly chitinised processes, slightly dilated at the apex, and exhibiting a sharpened and finely serrate edge; moreover, from a rounded prominence of this portion springs exteriorly a short, curved spine. The inner portion, too, is drawn out to a linguiform projection, with a small unguiform process at the tip, and has too, on the outer side, a strong spiniform process, whereas on the inner is affixed the cincinnigerous lobe. The appendages of the second pair of pleopoda (see figs. 28, 30) constitute an irregularly folded lamellar process, extending beyond the tip of the principal plate.

The telson (see fig. 26) exhibits the usual slender form, and has the apex somewhat produced and acutely pointed. The subapical spines are of moderate length, and perfectly smooth. Moreover, two pairs of very small denticles occur on the dorsal face of the telson.

The uropoda (*ibid.*) have the inner plate very narrow, and reaching almost to the tip of the telson when extended posteriorly. The outer plate is a trifle shorter, but much broader, and projects at the apex, exteriorly, as an acute corner.

The luminous globules agree perfectly both as to number and arrangement with those in *Euphausia*.

Colour.—Some specimens in the collection, preserved in glycerine, have the whole surface of the body, and more particularly that of the tail, dotted over with small stellate pigment-spots of a dark reddish colour.

Habitat.—Numerous specimens of this characteristic form were collected in the Expedition in different tracts of the ocean. Especially in one locality of the South Atlantic, the species would seem, to judge from the considerable number of specimens obtained, to have occurred in great abundance along with *Nematoscelis megalops*, a form of Euphausiidæ to be described further on. All the specimens were taken at the surface of the sea. The localities were as follows :—

Date.	Locality.
December 19, 1873.	South of Cape of Good Hope.
May 9, 10, 1874.	Off Australian coast.
June 14, 1874.	Off Australian coast.
June 15, 1874.	Off Australian coast, Sydney to Wellington.
July 10, 1875.	North Pacific.
July 1875.	North Pacific, Japan to Honolulu.
October 21, 1875.	South Pacific.
October 22, 1875.	South Pacific.
January 21, 1876.	South Atlantic, between Falkland Islands and Patagonia.
February 11, 1876.	South Atlantic, south of Buenos Ayres.
March 3 to 5, 1876.	South Atlantic, east of Buenos Ayres.
March 10, 1876.	South Atlantic.
March 11, 1876.	South Atlantic.
March 13, 1876.	South Atlantic.
May 6, 1876.	North Atlantic.

The same species I have also observed in the Mediterranean, at Messina.

Distribution.—The distribution of the species would accordingly seem to be very extensive, ranging, as it does, from the Mediterranean, throughout the whole of the North and South Atlantic, the Australian Seas, and the Pacific as far north as Japan.

32. *Thysanoëssa macrura*, G. O. Sars. (Pl. XXIII. figs. 1–4).

Thysanoëssa macrura, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 30.

Specific Characters.—Form of body very slender. Carapace with a single lateral denticle posterior to the middle of lower margin; rostral projection forming a triangular plate, broad at base, with apex acutely pointed. Caudal segments smooth above, with very small rounded epimera. Last segment exceedingly slender and elongate, preanal spine small, with only two denticles at posterior edge. Eyes somewhat smaller than in *Thysanoëssa gregaria*. Antennal scale very narrow, sublinear. First pair of legs much smaller than in last species, meral joint scarcely reaching beyond middle of antennal scale. Telson very slender. Inner plate of uropoda much longer than outer. Length reaching 13 mm.

Remarks.—This species may be at once distinguished from *Thysanoëssa gregaria* by the slender form of its body, and more particularly by the great length and slenderness of the last caudal segment. Moreover, the form of the rostrum is somewhat different, and the first pair of legs much less elongate than in that species.

Description.—Most of the specimens in the collection are immature; but a few examples would seem to be nearly full grown. The largest of these has a length of 13 mm. They are all females.

The form of the body (see Pl. XXIII. fig. 1) is much more slender than in the preceding species, and the tail in particular is remarkably elongate and narrow; hence the specific name.

The carapace resembles that in the last species, both as regards its general form and the situation of the lateral denticle, but differs in the shape of the rostral projection. The latter (see fig. 2) is not so sharply defined from the carapace as in that species, forming merely an appressed triangular process of the frontal margin, and terminating in a very acute point, that reaches beyond the middle of the basal joint of the antennulæ.

The caudal segments are very narrow, almost cylindrical, and provided with very small, rounded epimera. The last segment is remarkably elongate and slender, about as long as the two preceding taken together, and perfectly cylindrical in form. The preanal spine (fig. 4) is much smaller than in *Thysanoëssa gregaria*, and armed with only two denticles at the posterior margin.

The eyes (figs. 1, 2), although exhibiting a very similar form to those in the preceding species, are yet by comparison appreciably smaller.

The antennular peduncle (fig. 2) would seem to be a trifle more slender, agreeing, however, in other respects perfectly as to structure with those in *Thysanoëssa gregaria*.

The antennal scale (*ibid.*) likewise appears somewhat narrower, almost linear in form.

The first pair of legs (fig. 1) are not nearly so strongly developed as in the latter

species, the geniculate bend between the meral and carpal joints reaching to the middle only of the antennal scale.

The telson (see fig. 3) is very elongate and slender, with the apex acutely pointed and the subapical spines smooth.

The uropoda (*ibid.*) have the inner plate very considerably produced beyond the outer, and reaching to the tip of the telson.

Habitat.—All the specimens in the collection were taken in the tow-net at the surface of the sea. The following is a list of the localities :—

Date.	Locality.
December 24, 1873.	Southern Ocean, between Cape of Good Hope and Kerguelen.
December 29, 1873.	Southern Ocean, between Cape of Good Hope and Kerguelen.
January 23, 1874.	Southern Ocean, off Kerguelen.
February 3, 1874.	Southern Ocean, between Kerguelen and Heard Islands
February 14, 1874.	Antarctic Ocean, at the ice-barrier.
February 19, 1874.	Antarctic Ocean, at the ice-barrier.
February 14, 1876.	South Atlantic, south of Buenos Ayres.

As regards distribution, the species would therefore appear to be wholly confined within the southern hemisphere, inhabiting, as it does, exclusively the Antarctic and South Atlantic Oceans.

Genus 6. *Nematoscelis*, G. O. Sars, 1883.

Nematoscelis, G. O. Sars, Preliminary Notices on the Challenger Schizopoda.

Generic Characters.—Form of body and structure of eyes and antennæ almost as in *Thysanoëssa*. Mandibular palp very small. Terminal joint of second pair of maxillæ likewise exceedingly minute. Maxillipeds slender, with last joint somewhat appressed and densely setose at the inner edge; epipodite obsolete. First pair of legs remarkably elongate and slender, well-nigh filiform, with a bunch of spiniform setæ at the apex, but for the rest almost naked. The four succeeding pairs of legs rather short and thick, with the terminal part not nearly attaining the length of the meral joint. Penultimate pair of legs very small, with the endopod bi-articulate. Last pair of legs quite rudimentary, forming only a lamellar setiferous plate (exopod). The two anterior pairs of gills simple, and of a similar structure to those in *Thysanoëssa*; remaining pairs composed of two distinct branches; last pair by far the largest. Ovisac simple, flattened. Luminous apparatus of the usual structure.

Remarks.—This genus is most nearly allied to *Thysanoëssa*, but differs, among other characteristics, very materially in the structure of the legs, the first pair of which are

eminently distinguished by their great length and slender form, giving them a nearly filiform appearance, hence the generic denomination. Four different species of this genus are represented in the Challenger collection, a synopsis of which is given below :—

Carapace	without any lateral denticle. First pair of legs	longer than body. Eyes very large, . .	*N. megalops*, G. O. Sars.
		shorter than body. Eyes comparatively small,	*N. microps*, G. O. Sars.
	with a well-marked lateral denticle. Rostrum	acute, reaching to middle of basal joint of antennulæ. Body very slender, . .	*N. tenella*, G. O. Sars.
		greatly produced, reaching beyond middle of basal joint of antennulæ. Body comparatively short, ...	*N. rostrata*, G. O. Sars.

33. *Nematoscelis megalops*, G. O. Sars (Pl. XXIII. figs. 5–10 ; Pl. XXIV.).

Nematoscelis megalops, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 31.

Specific Characters.—Body rather thickset, gradually tapering from before backwards. Carapace without any lateral denticles, anterior part keeled above, rostrum exceedingly narrow, subulate, curving gently downward. Penultimate and antepenultimate caudal segments slightly keeled above, and jutting out in the middle of the posterior margin as small dentiform projections. Last segment longer than preceding; preanal spine unguiform, with a small denticle at base. Eyes of enormous size, irregularly globose, cornea contracted in middle. Antennal scale reaching almost to the tip of the antennular peduncle, exceedingly slender, linear, apex narrowly truncate, with outer corner projecting. First pair of legs remarkably elongate and slender, attaining, when fully extended, the length of the whole body, meral joint reaching far beyond tip of antennular peduncle, propodal joint a trifle shorter than carpal; terminal joint very minute. Telson rather elongate, with apex acutely produced; subapical spines smooth. Inner plate of uropoda longer than outer, and projecting beyond tip of telson. Length 26 mm.

Remarks.—The present species may be regarded as the type of this genus, and is chiefly characterised by the extraordinary length of the first pair of legs and the prodigious development of the eyes, as also by its remarkably narrow and curved rostrum, and the slender form of the antennal scale.

Description.—All the specimens in the collection are females, the largest has a length of 26 mm.

The body (Pl. XXIII. figs. 5, 6) is rather thickset and but slightly compressed, tapering gradually from before backwards, with the tail about twice the length of the anterior division.

The carapace is comparatively short, and lacks every trace of lateral denticles, the inferior margins being perfectly smooth and slightly incurved in the middle. The

anterior part has a well-marked keel running along the dorsal face, and juts out as an exceedingly narrow, subulate rostrum, curving gently downward, and reaching almost to the end of the basal joint of the antennulæ (see figs. 8, 9). The antero-lateral corners of the carapace are produced into an acute lobe, overlapping at the side the basal part of the antennæ. The posterior emargination is somewhat deep, exposing as usual the dorsal part of the last segment of the trunk.

The caudal segments diminish successively both in height and breadth posteriorly, and have the epimera distinctly projecting beneath the ventral face, and of a rounded form The antepenultimate and penultimate segments are slightly keeled above, the keel jutting out posteriorly into small dentiform projections. The last segment is appreciably longer than any of the preceding, and a little compressed, exhibiting a distinct unguiform preanal spine, usually found armed at the base with a small secondary tooth (fig. 7).

The eyes (see Pl. XXIV. fig. 1) are prodigiously developed, and of larger size, perhaps, than in any other known form of Podophthalmia. They are irregularly globose in shape, with the cornea greatly expanded, and, as it were, divided into two sections by a well-marked transverse impression running straight across the middle.

The antennular peduncle (Pl. XXIV. fig. 2) is rather slender, and exhibits a structure very similar to that in the genus *Thysanoëssa*, the basal joint being rather flattened, whereas the two outer ones are narrow, cylindrical, about equal in length, and, taken together, as long as the basal joint. The anterior border of the basal joint projects somewhat above, and has, as in *Thysanoëssa*, a distinct indentation in the middle, the outer corner jutting out as an acute denticle, whereas the inner is obtuse and provided with two very strong recurved setæ. The flagella are, as in *Thysanoëssa*, very short, scarcely exceeding half the length of the peduncle.

The antennal scale (fig. 3) exhibits a remarkably narrow, nearly linear form, and reaches almost to the tip of the antennular peduncle; its apex is very narrowly truncate, with the outer corner projecting as a small tooth, the inner rounded off. The basal spine is very short and quite smooth. The flagellum is poorly developed, with the peduncle very narrow and not nearly attaining the length of the scale, the terminal part being somewhat shorter than the peduncle, and composed of sixteen to eighteen short articulations.

The anterior lip (fig. 4) exhibits the usual galeate form, with the lateral angles, however, but slightly produced.

The posterior lip (fig. 5) has the terminal lobes somewhat expanded and triangular in form, exhibiting exteriorly a distinct and nearly right angle.

The mandibles (fig. 6) exhibit, as to the form of the body, a perfectly normal appearance, the cutting edges (fig. 7) being divided into several sharply pointed teeth. The palp, on the other hand (figs. 6, 8), is remarkably small, not even attaining half the length of the body of the mandible. It is, moreover, very narrow, and but sparingly furnished with bristles, with the terminal joint exceedingly minute and lamelliform.

The first pair of maxillæ (fig. 9) are, on the whole, developed in the usual manner. The terminal joint is rather narrow, and bears at the apex a double series of unequal bristles, some of which are very slender. The exognath is comparatively much smaller than in the genus *Thysanoëssa*, and forms an oval lamella, fringed along the anterior part with a dense row of ciliated bristles.

The second pair of maxillæ (fig. 10) exhibit a somewhat more deviating appearance, having the masticatory lobes remarkably broad and arcuate at the edges, with the hinder one not subdivided by a distinct indentation. The terminal joint, or palp, is exceedingly small, lamelliform, and somewhat constricted at the base, its apex being obtusely truncate and edged round with slender setæ. The exognath, finally, is rather small, forming merely a slight expansion of the outer edge of the basal part, but exhibiting the usual fringe of ciliated bristles.

The maxillipeds (fig. 11) are rather slender and pediform, reaching, when fully extended, almost to the middle of the antennal scale. Of the joints the meral and ischial are nearly equal in length, the latter, however, being much more expanded and almost lamellar. The terminal joint (fig. 12) is somewhat compressed, and exhibits along the inner edge a dense row of comparatively short, ciliated bristles. The exopodite does not differ in size and structure from the true exopods of the legs. Of an epipodite no trace can be detected.

The first pair of legs (fig. 13) are very remarkable, both as regards their great length and slender aspect, and their very peculiar structure. When fully extended, they exceed in length even the whole body; but, as a rule, they are found to exhibit, as in *Thysanoëssa*, a sharp geniculate bend between the meral and carpal joints, the terminal section being reflexed at a more or less acute angle. The proximal part of the leg, comprising the coxal, basal, and ischial joints, appears rather strong and muscular, exhibiting along the inner edge a row of very small bristles. The remaining part, on the other hand, is extremely slender, indeed almost filiform, also very brittle and therefore easily broken off if the specimens be not handled with the greatest care. This part, moreover, lacks every trace of marginal bristles, being quite naked throughout, save at the apex, where a dense assemblage of peculiar spines springs forth in the form of a brush. Of the joints, the meral is much the longest, reaching far beyond the tip of the antennulæ, and being very movably jointed to the ischial, exhibiting a peculiar curve at its base. The carpal and propodal joints are likewise very slender, the former being a trifle longer than the latter, whereas the terminal joint is exceedingly minute, and firmly connected, it would seem, with the preceding. It bears (fig. 14) six slender, straight spines, which, together with two similar ones originating interiorly from the end of the preceding joint, constitute the above mentioned peculiar apical brush. The spines, when highly magnified, present a very curious appearance, being, as it were, annulated at regular intervals, and jutting out at each annular segment as a recurved denticle, thus giving to one of the edges a

densely serrate aspect. What the real function of this peculiarly modified pair of legs is, I am wholly unable to state. Meanwhile, we have every reason to assume that so remarkable a structure cannot but stand in close connection with some unknown requirement bearing on the vital phenomena of the animal.

The four succeeding pairs of legs (figs. 16–20) are comparatively very short and somewhat clumsy in structure, with the joints slightly compressed and fringed along the inner edge with slender bristles. Of the joints, the ischial and meral are the largest, and nearly equal in length. The terminal part, comprising the three outer joints, is remarkably short, not nearly attaining the length of the meral joint, and exhibits several strong spiniform bristles, six to eight of which issue from the very small terminal joint (fig. 17).

The penultimate pair of legs (figs. 21, 22) are exceedingly small, and almost hidden between the gills, but have both the endopod and exopod distinctly defined. The former consists, as in *Thysanoëssa*, of only two joints, the terminal the longer, both with a few scattered bristles along their inner edge.

The last pair of legs (fig. 22, 23) are quite rudimentary, each forming merely a small laminar plate, originating from a short basal part. This plate, which undoubtedly represents the exopod, is somewhat unlike that in *Thysanoëssa*, being rather expanded and broadly truncate at the apex, which, together with the inner edge, is fringed with a dense row of ciliated bristles.

The gills are rather fully developed, forming a broad fringe beneath the carapace along the sides of the trunk (see Pl. XXIII. fig. 10), and, as usual, increasing successively in size from before backwards. The two anterior pairs (Pl. XXIV. figs. 13, 16, 24) exhibit much the same appearance as in *Thysanoëssa*, constituting, as they do, single stems, expanded at the apex into two recurving corners, and with a regular series of digitiform gill-lobules along the posterior edge. The four succeeding pairs (figs. 25–28), on the other hand, are all of them double, or exhibit two distinctly defined stems, the outer of which corresponds perfectly in structure with the two anterior pairs of gills, whereas the inner stem is bent inward, exhibiting a somewhat pyramidal form, and furnished at both edges with a clustering assemblage of gill-lobules. This stem, too, is not, as in *Thysanoëssa*, connected with the outer one, but would seem to spring separately from the coxal joint of the leg, becoming, as usual, gradually more complex posteriorly. The last pair of gills (fig. 29) are very large and complex in structure, consisting of two principal portions that point in opposite directions, both, but especially the outer one, being richly arborescent.

The pleopoda of the female do not exhibit any marked peculiarities; those of the male I had no opportunity of examining, the collection containing female specimens only.

The telson (see fig. 30) is very slender and elongate, attaining nearly the length of

the two preceding segments taken together. It tapers toward the apex, produced as an acute point. The subapical spines are of moderate size and smooth. Moreover, two pairs of small denticles occur on the dorsal face of the telson.

The uropoda (see fig. 30) have both plates very narrow, the inner one being appreciably longer than the outer, and projecting beyond the tip of the telson.

The luminous globules agree perfectly, both in number and arrangement, with those in *Euphausia*.

Habitat.—The collection contains comparatively numerous specimens of this interesting species, the greater part having been taken from the surface of the sea at two adjacent Stations of the South Atlantic. The species also occurred in two other localities, but much less abundantly. The localities are the following:—

Date.	Locality.
May 21, 1873.	North Atlantic, off Nova Scotia.
March 9, 1876.	South Atlantic (Station 331).
March 10, 1876.	South Atlantic (Station 332).
March 13, 1876.	South Atlantic (Station 333).

The distribution of the species therefore, as yet known, would appear to be restricted to the Atlantic Ocean.

34. *Nematoscelis microps*, G. O. Sars (Pl. XXV. figs. 1–4).

Nematoscelis microps, G. O. Sars, Preliminary Notices on the Challenger Shizopoda, No. 32.

Specific Characters.—Body somewhat more slender than in the preceding species. Carapace without any lateral denticles, anterior part very slightly keeled above, rostral projection straight, acute, flattened at base. Caudal segments smooth above. Eyes much smaller than in *Nematoscelis megalops*, cornea narrowed in the upper part. Antennal scale projecting but slightly beyond second joint of antennular peduncle, less narrow than in preceding species, apex obtusely rounded. First pair of legs, when fully extended, shorter than body, propodal joint longer than carpal, terminal joint oblong, constricted at base, with about six spines, one of which is much longer than the others. Telson and uropoda nearly as in *Nematoscelis megalops*. Length 16 mm.

Remarks.—This species may be readily distinguished from the preceding by the much smaller eyes, the less elongate first pair of legs, and the form of the rostral projection. It is, moreover, rather inferior in size, and also a trifle more slender.

Description.—Only three female specimens of this form were taken during the Expedition, the largest having a length of 16 mm.

The form of the body (see Pl. XXV. fig. 1), as compared with that of the preceding species, appears somewhat more slender, and less dilated anteriorly.

The carapace lacks, as in that species, every trace of lateral denticles, and is somewhat more elongate in proportion to its height. The anterior part is very slightly keeled above, and juts out as an acute rostral projection, reaching beyond the middle of the basal joint of the antennulæ. This projection, too, is quite straight, with the basal part rather broad and flattened. The antero-lateral corners of the carapace are not nearly produced to the same extent as in *Nematoscelis megalops*.

The caudal segments are perfectly smooth above, none of them being keeled as in the preceding species. The epimera are comparatively small and evenly rounded. The last segment is rather elongate, and exhibits a very small simple preanal spine.

The eyes (see fig. 2) are not nearly so largely developed as in the last species, being comparatively small, with the cornea somewhat narrowed in its upper part.

The antennular peduncle (*ibid.*) exhibits a structure closely resembling that in *Nematoscelis megalops*, but having the two outer joints a trifle more elongate.

The antennal scale (*ibid.*) does not nearly reach the tip of the antennular peduncle, and would seem on the whole to be apparently less slender than in the last species, with the apex obtusely rounded and the outer corner but slightly projecting.

The first pair of legs (see fig. 1) are rather slender and elongate, though not nearly to the same extent as in the last species, being, when fully extended, somewhat shorter than the body. Of the joints the meral, as in that species, is by far the longest, reaching a little beyond the tip of the antennular peduncle. The relation in size between the two succeeding joints is, on the other hand, somewhat different from that in *Nematoscelis megalops*, the propodal joint being the longer of the two. Finally, the terminal joint (fig. 3), though comparatively small, is somewhat more fully developed than in the above-mentioned species, and also, it would seem, very movably connected with the preceding joint. It exhibits an oblong form, being slightly dilated in the middle and constricted at the base, and has six very unequal spines, one of which is very large and strong, projecting far beyond the rest. No spines arise, as in *Nematoscelis megalops*, from the end of the preceding joint.

The succeeding pairs of legs, as also the gills and the pleopoda, would seem to agree in all respects with those of *Nematoscelis megalops*.

The telson (see fig. 4) appears somewhat less elongate than in that species, exhibiting, however, for the rest, a very similar aspect.

The uropoda (*ibid.*) have the inner plate somewhat longer than the outer, projecting however but very little, if at all, beyond the tip of the telson.

One of the specimens, mounted in Canada balsam on a glass slide, is ovigerous. The ova, which are rather numerous, lie enclosed within a single oblong ovisac, extending beneath the trunk, almost throughout the whole of its length (see fig. 1).

Habitat.—The three specimens in the collection were taken at the surface of the sea in the two following localities :—

Date.	Locality.
? April 29, 1876.	Pacific, north of the Sandwich Islands. North Atlantic.

In the year 1876 I took a few specimens of the same species in the Mediterranean at Messina.

Hence it would seem to have a rather extensive distribution, the above-mentioned localities lying in widely distant tracts of the ocean.

35. *Nematocelis tenella*, G. O. Sars (Pl. XXV. figs. 5, 7).

Nematoscelis tenella, G. O. Sars, Preliminary Notices on the Challenger Schiopoda, No. 33.

Specific Characters.—Form of body very slender and elongate. Carapace with a well marked, though small, lateral denticle behind the middle of the inferior margin ; anterior part slightly keeled above ; rostral projection rather narrow, straight, acuminate. Caudal segments smooth above, with very small rounded epimera. Last segment rather elongate, preanal spine exceedingly minute. Eyes not very large, subclavate, cornea comparatively small and narrow. Antennular peduncle slender and elongate. Antennal scale not projecting beyond second joint of antennular peduncle, very narrow, linear, apex obtusely truncate. First pair of legs, when fully extended, much shorter than body, meral joint scarcely projecting beyond antennular peduncle, propodal joint longer than carpal, terminal joint sublinear, with only four spines. Gills comparatively simple in structure, with short papillar lobules. Length 10 mm.

Remarks.—The specimens of this form, contained in the collection, have much the appearance of immature animals, but will not, in my judgment, admit of being referred to either of the two species described above, since the carapace has in all of them a well-marked lateral denticle, totally absent in the former. Moreover, several other characters would seem to warrant the specific difference of the present form.

Description.—None of the specimens exceed a length of 10 mm., and all have the appearance of being females.

The form of the body (see Pl. XXV. fig. 5) is exceedingly slender and elongate, nearly cylindrical throughout.

The carapace exhibits a form rather similar to that in *Nematoscelis microps*, but differs in having on either side a well-marked, though somewhat small, lateral denticle,

arising from the inferior margin behind the middle, or, more precisely, just above the point of insertion of the penultimate pair of legs. Its anterior part has a distinct, though not very prominent keel running along the middle, and juts out as a rather narrow and somewhat flattened rostral projection, reaching about the middle of the basal joint of the antennulæ.

The caudal segments are perfectly smooth above, and very narrow, with exceedingly small, rounded epimera. The last segment is appreciably longer than any of the preceding, and has a very small, simple preanal spine.

The eyes (see figs. 5, 6) are not very large, and of a somewhat clavate form, with the cornea very narrow, and occupying but a small part of each eye.

The antennular peduncle (*ibid.*) is very slender and elongate, attaining almost the length of the carapace. The flagella, on the other hand, are exceedingly short, scarcely exceeding half the length of the peduncle.

The antennal scale (see fig. 6) does not reach beyond the second joint of the antennular peduncle, and is very narrow, linear, with the apex obtusely truncate, and the outer corner but slightly projecting.

The first pair of legs (see fig. 5) are comparatively shorter than in either of the two preceding species, and do not nearly attain the length of the body, when fully extended. The geniculate bend between the meral and carpal joints extends to about the tip of the antennular peduncle. The propodal joint, as in *Nematoscelis microps*, is slightly longer than the carpal, and the terminal joint is very narrow, almost linear, and provided with only four slender spines, one of which projects far beyond the rest.

The succeeding pairs of legs are very small, and difficult to examine without dissection.

The gills are apparently far less complex in structure than the corresponding parts in the two preceding species, the gill-lobules being few in number and merely papillar in form.

The caudal fan does not exhibit any essential difference from that in *Nematoscelis microps*.

Habitat.—A few specimens of this slender species have been collected at the surface of the sea, in five different localities :—

Date.	Locality.
December 19, 1873.	South of the Cape of Good Hope.
October 27, 1874.	Samboangan to Ilo Ilo, Philippines.
October 1874.	Off Mindanao, Philippines.
April 9, 1876.	Tropical Atlantic.
April 13, 1876.	Tropical Atlantic, off the coast of Africa.

The distribution of the species would accordingly seem to range from the tropical part of the Atlantic to the tract of ocean surrounding the Indian Archipelago.

36. *Nematoscelis rostrata*, G. O. Sars (Pl. XXV. figs. 8–10).

Nematoscelis rostrata, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 34.

Specific Characters.—Form of body much shorter and stouter than in the last species. Carapace with a very strong lateral denticle at posterior part of inferior margin, and a conspicuous rounded crest above anterior to the middle; rostrum greatly produced, reaching almost to the end of the basal joint of the antennulæ, straight, acuminate, broad and flattened at the base. Caudal segments smooth above, with small rounded epimera. Eyes rather large, irregularly pyriform, cornea narrowed in upper part. Antennal scale comparatively small, reaching scarcely to the end of the second joint of the antennular peduncle. First pair of legs shorter than in the other species, meral joint reaching hardly to tip of antennular peduncle, propodal joint longer than carpal, terminal joint slightly dilating toward the tip, with five spines. Gills and caudal fan as in *Nematoscelis tenella*. Length 8 mm.

Remarks.—This form also, it would seem, is represented in the collection only by immature specimens. I have nevertheless felt warranted in establishing a new species for their reception, differing, as they do, in several respects distinctly from any of the preceding species. Thus, the body is comparatively much shorter, the rostrum more produced; and besides, the strongly developed lateral denticle of the carapace, as also the conspicuous dorsal crest, would seem to afford well-marked specific characters.

Description.—The length of the specimens in the collection does not exceed 8 mm., and therefore this form must be regarded as one of the smallest Euphausidians. All the specimens are females.

The form of the body (see Pl. XXV. fig. 8), as compared with that of *Nematoscelis tenella*, is much shorter and more thickset, as also somewhat compressed.

The carapace is comparatively short in proportion to its height, and has on either side a very strong lateral denticle, jutting out from the hinder part of the inferior margins about where that corresponding to it projects in *Nematoscelis tenella*. On the dorsal face, moreover, a very conspicuous rounded crest occurs at some distance in front of the middle, disappearing before it reaches the base of the rostrum. The latter is greatly produced, extending far beyond the middle of the basal joint of the antennulæ, and is quite straight, ending in a sharp point. Viewed from above (fig. 9), the rostrum appears broad and flattened at the base, tapering gradually toward the extremity.

The caudal segments are smooth above and appreciably broader than in the last species, the epimera, however, being very small. The last segment is longer than the preceding, aud has a very small simple preanal spine.

The eyes (see figs. 8, 9) are comparatively large, irregularly pyriform, and slightly flattened, with the cornea oblong in form and somewhat narrowed in its upper part.

The antennular peduncle (*ibid.*) appears a trifle less elongate than in *Nematoscelis tenella*, for the rest exhibiting a very similar structure.

The antennal scale (see fig. 9) does not quite reach to the end of the second joint of the antennular peduncle, and would seem to be a trifle broader than in the last species.

The first pair of legs (see fig. 8) are comparatively shorter than in any of the preceding species, but in other respects resemble those in *Nematoscelis tenella*. The terminal joint expands gradually toward the apex, which is abruptly truncate, and provided with five spines, one of which projects appreciably beyond the rest.

The gills exhibit much the same simple appearance as in the last species.

The caudal fan, likewise, would not seem to exhibit any essential difference in its structure from that in *Nematoscelis tenella*.

Habitat.—Several specimens of this form were collected during the Expedition, but the greater part are more or less defective. All were taken in the tow-net. The localities are the following :—

Date.	Locality.
August 27, 1873.	Tropical Atlantic, off St. Paul's Rocks.
August to September 1875.	Pacific.
February 1875.	Pacific, north of New Guinea.
March 3, 1876.	South Atlantic.
March 31, 1876.	South Atlantic.
April 6, 1876.	Tropical Atlantic.
April 9, 1876.	Tropical Atlantic.
April 13, 1876.	Tropical Atlantic, off the coast of Africa.
May 3, 1876.	North Atlantic.
May 12, 1876.	North Atlantic.

As regards distribution, it would appear from the above given localities, that the species is met with throughout the whole of the Atlantic, occurring also in the Pacific.

Genus 7. *Stylocheiron*, G. O. Sars, 1883.

Stylocheiron, G. O. Sars, Preliminary Notices on the Challenger Schizopoda.

Generic Characters.—Form of body somewhat varying in the different species. Eyes more or less irregularly formed. Flagella of the two pairs of antennæ very slender, with few and elongate articulations. Mandibles without palp. First pair of maxillæ wanting exognath; second pair small, with indistinctly defined masticatory lobes, fringed with but a single row of slender setæ. Maxillipeds feeble in structure, with greatly developed exopodite, but wanting epipodite. Legs rather dissimilar; first pair of same appearance as maxillipeds; second pair greatly produced, geniculate, meral and carpal joints very elongate and slender, naked, propodal joint somewhat swollen, and armed with strong spiniform bristles impinging against the curved spines arising from terminal joint, the

two forming together a kind of grasping organ. Succeeding legs much smaller and rapidly diminishing in length, the two anterior pairs with proximal part much compressed, laminar; antepenultimate pair with endopod bi-articulate; last pair quite rudimentary, forming each merely a small setiferous lamella. Gills rather simple in structure, last pair largest. Ovisac single. Only three luminous globules present, one ventral belonging to the first caudal segment, and two lateral at the bases of the penultimate pair of legs, the latter in the male very fully developed and supplied with an additional lens.

Remarks.—This is a very distinct genus, and characterised most prominently by the strong and peculiar development of the second pair of legs, which are modified so as to form grasping organs. Moreover, it differs in several other respects, as will be seen from the above diagnosis, not a little from other Euphausiidæ, though exhibiting perhaps a certain affinity to the genus *Nematoscelis*.

Five different species of this remarkable genus are represented in the Challenger collection. All of these are comparatively very small, but undoubtedly cannot be regarded as larval stages, since in one of the species at least, both ovigerous females and adult males have been observed. This genus I had previously met with, having observed one of its species in the Mediterranean, at Messina, in the year 1876.

The following is a synopsis of the species :—

- Carapace
  - distinctly carinate above, with a conspicuous rounded crest anterior to the middle. Rostrum very narrow, acute. Eyes large, with cornea narrowed in upper part, ... *S. carinatum*, G. O. Sars.
  - but slightly keeled above in anterior part. Eyes
    - comparatively small, with cornea very much narrowed in upper part. Rostrum acute, . *S. suhmii*, G. O. Sars.
    - rather large, compressed, with cornea narrow, oblong. Last caudal segment
      - not longer than preceding. Rostrum acutely produced, . *S. longicorne*, G. O. Sars.
      - exceedingly elongate and slender. Rostrum very short, . *S. elongatum*, G. O. Sars.
  - remarkably short, with rather produced rostrum. Eyes exceedingly large and thick. Outer part of second pair of legs forming a complete chela, ... *S. abbreviatum*, G. O. Sars.

37. *Stylocheiron carinatum*, G. O. Sars (Pl. XXVI.).

Stylocheiron carinatum, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 35.

Specific Characters.—Form of body rather thickset in male, somewhat more slender in female. Carapace short in proportion to height, distinctly carinated above, and forming an elevated crest behind base of rostrum; the latter very narrow and acutely produced. Last caudal segment longer than preceding. Eyes large, irregularly

pyriform, cornea narrowed in upper part. Antennular peduncle shorter than carapace; the two outer joints subequal, very slender in female, but strongly dilated in male. Antennal scale projecting scarcely beyond second joint of antennular peduncle, oblong, apex obliquely truncate. Second pair of legs, when fully extended, not attaining length of body, carpal joint shorter than meral, and near the apex bearing a curved spine, propodal joint with three strong ciliate bristles at inner edge; terminal joint very small, with apical spines subequal. Inner plate of uropoda longer than outer. Length 11 mm.

Remarks.—Of this species I have had an opportunity of examining several specimens, both adult females and males, whereas the other species are represented in the collection merely by solitary specimens. Hence, the generic characters have been chiefly based upon an anatomical investigation of the present form, which accordingly may be regarded as the type of the genus.

Description.—The length of the largest female specimen measures 11 mm. The males are, as a rule, a trifle smaller.

The form of the body is somewhat more slender in the females (Pl. XXVI. fig. 1) than in the males (fig. 19), but in both it would appear, on the whole, to be rather thick-set.

The carapace is somewhat short in proportion to its height, more especially in the males, and lacks every trace of lateral denticles. Above it is distinctly carinate throughout a great part of its length, the carina forming anteriorly an elevated crest which ends abruptly at some distance behind the base of the rostrum. The latter is very narrow, perfectly straight, and projects beyond the middle of the basal joint of the antennulæ, its apex being sharply pointed. The antero-lateral corners of the carapace are produced at an acute angle.

The caudal segments are smooth above, and furnished with comparatively small rounded epimera. The last segment is rather elongate, about as long as the two preceding segments taken together, and exhibits a very small, unguiform preanal spine.

The eyes are rather large, more especially in the male, irregularly pyriform, with the cornea considerably expanded below and somewhat narrowed in its upper part.

The antennular peduncle in the female (fig. 3) is rather slender and elongate, though a trifle shorter than the carapace, and exhibits a structure much resembling that in the genus *Nematoscelis*, the basal joint being considerably flattened, whereas the two outer joints are very narrow, cylindrical, subequal, and, taken together, somewhat longer than the basal. Of the flagella, the outer part was broken off in all the specimens, but to judge from the still remaining basal part, they would seem to have been extremely slender, with narrow and elongate articulations. In the male, the antennular peduncle (fig. 21) has a much more powerful development, the two outer joints being greatly dilated, and, taken together, somewhat shorter than the basal. Of the flagella, only the basal parts remain, but, to judge from what is left, they must probably likewise have been rather

more powerful than in the female. The outer flagellum more especially is distinguished by a very thick, and, as it were, swollen base.

The antennal scale (fig. 4) projects but slightly beyond the second joint of the antennular peduncle, and exhibits a regular oblong-linear form, its length being about four times greater than its breadth. The apex is obliquely truncate, with the inner corner projecting, the outer jutting out as a small denticle. Of the flagellum, here too the outer part was broken off in all the specimens; its peduncle is exceedingly slender and projects far beyond the scale, with the middle joint very elongate, nearly three times as long as the terminal.

The anterior lip (see fig. 5) exhibits the usual galeate form, but would seem to be relatively somewhat smaller than in other Euphausiidæ.

The posterior lip (fig. 6) has the terminal lobes somewhat rounded, without a distinctly marked outer angle.

The mandibles (see fig. 5) are eminently distinguished by the total absence of the palp. Their masticatory parts (fig. 7) appear a trifle less strongly expanded than in most other Euphausiidæ, but with the cutting edges divided in the usual manner into several acute teeth, having likewise posteriorly a well-marked molar protuberance.

The first pair of maxillæ (fig. 8) do not exhibit any trace of the usual lamellar exognath, but for the rest would seem to be of normal appearance, except that both of the masticatory lobes have a comparatively small number of setæ and spines. The terminal joint is lamelliform, oval, and, as usual, provided along the inner edge with a double row of bristles.

The second pair of maxillæ (fig. 9) are rather small and membranous throughout, exhibiting, on the whole, a less perfect development than in other Euphausiidæ. The masticatory lobes are only two in number and project but very little, forming merely slight expansions of the inner edge of the basal part, fringed with a single row of slender ciliated bristles. Of the lobes, the inner one is by far the shorter, and has only five bristles. The terminal joint is very short, appearing as a mere direct continuation of the basal part, though separated by a distinct transverse suture; it is furnished with three bristles only, springing from the inner edge. The exognath forms a slight expansion of the outer edge of the basal part, and is fringed with about nine plumose setæ, increasing in length anteriorly.

The maxillipeds (fig. 10) have the stem, or endopodite, comparatively small, reaching but very little beyond the basal part of the antennæ, and rapidly tapering toward the apex, the outer part being very slender. The masticatory process, issuing from the coxal joint, is conically produced, and bears at the tip three diverging setæ. The basal joint is rather broad and compressed, and also the ischial joint is decidedly laminar, though considerably narrower, both furnished along the inner edge with very short bristles. The meral joint is somewhat longer than the ischial, but very much narrower, and has like-

wise a row of delicate bristles along the inner edge. The terminal part of the maxilliped, comprising the three outer joints, is extremely slender, and about equals in length the meral joint. Of its joints, the middle one is the longest, whereas the last (fig. 11) is exceedingly small and truncate, bearing at the tip four ciliated bristles. The exopodite (see fig. 10) is remarkably large, projecting even beyond the tip of the endopodite, with the basal part very elongate and muscular. The epipodite is wholly wanting.

The first pair of legs, which in the two preceding genera are the ones peculiarly modified, are in the present genus of exactly the same structure as the maxillipeds, save their being a trifle more elongate, with the masticatory process obsolete and the exopod somewhat shorter.

The second pair of legs (fig. 22), on the other hand, are developed in a very peculiar manner, being altogether dissimilar to any of the others. They are very elongate and slender, also strongly geniculate, recalling to a certain extent the structure characteristic of the first pair in the genus *Nematoscelis*, but differing materially in the deviating form of the two last joints. In the female (fig. 1) they are somewhat more elongate than in the male, about equalling, when fully extended, the posterior division of the body in length ; but in other respects they fully agree in both sexes. Of the joints, the meral and carpal are exceedingly produced and very movably connected, the former being by far the longer. The carpal joint exhibits at the end a slight projection of the inner edge, bearing a short curved spine ; but for the rest both these joints are perfectly smooth. The propodal joint is much shorter than the carpal, attaining scarcely half its length, but appears somewhat thicker, and, as it were, swollen, as also provided at both edges with three strong spiniform bristles, those of the inner edge being by far the longer. The terminal joint, finally, is very small, and bears five similar bristles, curving in a direction opposite to that taken by those on the inner edge of the preceding joint. Thus both these outer joints form together, as it were, a kind of grasping hand, though not so decidedly prehensile in this as in the other species of the genus.

The two succeeding pairs of legs (figs. 12, 13) differ very considerably in appearance both from the first and second pairs. They are somewhat short, with the proximal part of the endopod strongly appressed and laminar, as also gradually tapering toward the tip of the meral joint. The ischial joint in both pairs is much the largest, being several times longer than the meral ; both have a few slender bristles along the inner edge. The terminal part is distinctly tri-articulate in the third pair (fig. 12), and somewhat longer than the meral joint, whereas in the fourth pair (fig. 13) this part is exceedingly small and only bi-articulate.

The fifth or antepenultimate pair of legs (fig. 14) present an aspect, not agreeing with any of the preceding pairs. They are rather small and have the endopod consisting of only three joints, the first much the largest, somewhat curved, and provided along the inner edge with a row of eight strong ciliated setæ. The succeeding (meral) joint has on

either side, near the extremity, a very slender, non-ciliated bristle. Finally, the last joint, representing the terminal part in the preceding legs, is exceedingly narrow, and bears four similar bristles, one of which issues from the outer edge, the other three from the tip ; one of the latter is extremely elongate.

The penultimate pair of legs (fig. 15) are still smaller and simpler in structure, with the endopod consisting of only two joints of almost equal size, the terminal one somewhat curved, and provided at the tip with four remarkably long and slender, non-ciliated bristles. The exopod in this as well as the preceding pair is very small, though with both its sections well defined.

The last pair of legs (figs. 16, 17) are quite rudimentary, each forming merely an ovoid, setiferous lamella (exopod), originating from a short basal part connected with the corresponding gill-stem.

The gills (see fig. 2) exhibit on the whole a rather simple structure, all, except the last pair, forming single stems, more or less expanding at the tip, and bearing a regular series of digitiform gill-lobules. On the two first pairs two such lobules only are present ; on the succeeding pairs the number gradually increases from four to eight. The last pair (figs. 2, 16, 24) are somewhat more complex, exhibiting the two usual divisions, the outer of which is the larger, and bears three or four secondary gill-branches.

The pleopoda in the female exhibit the usual structure. In the male, the two anterior pairs are slightly modified, the inner plate having a sexual or copulatory appendage. On the first pair, this appendage (figs. 25, 26) consists apparently of two portions, the outer bearing at the tip two rather short and somewhat hamate processes, together with a short curved spine, the inner portion simple lobular. On the second pair, the appendage (fig. 27) is comparatively large, projecting far beyond the principal plate, and exhibits at the somewhat dilated extremity several twisted lobes.

The telson (see fig. 18) has the usual slender form, tapering towards the apex, which terminates in a sharp point. The subapical spines are not very large, projecting but slightly beyond the tip of the telson, and perfectly smooth. Furthermore, two pairs of small denticles occur on the dorsal face of the telson.

The uropoda (*ibid.*) are likewise quite normal in structure, having the inner plate somewhat longer than the outer, and reaching nearly to the tip of the telson.

The luminous apparatus, so uniformly developed in most other Euphausiidæ, exhibits in this genus certain well-marked peculiarities. Thus the globules are considerably reduced in number, only three of them being developed, viz., one odd one between the bases of the first pair of pleopoda, and a pair of lateral globules at the bases of the penultimate pair of legs (see figs. 1, 19). On the other hand, the latter globules attain in the male (figs. 20, 23) an extraordinary development, being more than twice as large as those in the female. Moreover, a supplementary lens, formed, it would seem, by a thickening of the outer integument, is subjoined at some distance from the globule, and

in such a position as to admit of the front part of the globule being brought precisely in the same axis. Thus, no doubt, a much more complete condensation of light may be effected than could possibly result from the action of the globule alone. Within the ocular pedicle occurs, moreover, in both sexes, a luminous organ, similar in structure to the one described above in *Euphausia* (see fig. 1).

Of the female specimens in the collection, two were ovigerous. The ova are (see fig. 1) very large, and of course few in number, as also contained within a common saccular envelop, oblong and somewhat flattened, and extending beneath the greater part of the trunk. The peculiar slender, non-ciliated bristles issuing from the endopods of the antepenultimate and penultimate pairs of legs in the female, serve most probably for affixing the ovisac and keeping it *in situ*.

Habitat.—The specimens in the collection were all taken by the tow-net, in the following localities :—

Date.	Locality.
August 11 to 12, 1874.	Pacific, off Kandavu, Fiji Islands.
October 1874.	Off Mindanao, Philippine Islands.
February 1875.	North Pacific.
March 21, 1876.	South Atlantic.

The range of the species would accordingly seem to be rather extensive, comprising, as it does, the South Atlantic and Pacific Oceans, as also the Celebes Sea.

38. *Stylocheiron suhmii*, G. O. Sars (Pl. XXVII. figs. 1–4).

Stylocheiron suhmii, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 36.

Specific Characters.—Form of body rather short. Carapace larger than in last species, without any distinct dorsal crest, rostral projection triangular, acute. Last caudal segment scarcely longer than preceding. Eyes smaller than in *Stylocheiron carinatum*, cornea much narrowed in upper part. Antennular peduncle in female exceedingly slender, equalling carapace in length, last joint longer than second. Antennal scale projecting considerably beyond second joint of antennular peduncle, very narrow, linear, apex obliquely truncate. Second pair of legs almost as long as the body, carpal and meral joints subequal, propodal joint with three slender spines at end of inner edge, terminal joint produced as a strong unguiform spine and with two shorter spines springing from either side. Uropoda shorter than telson, terminal plates subequal. Length 8 mm.

Remarks.—Among the drawings executed by the late Dr. v. Willemoes-Suhm during the Expedition, there is one representing this form, and as the species, therefore, may be

said to have been discovered by that lamented naturalist, I have deemed it advisable to associate his name with this form, although he was clearly misled in regarding it as a male *Euphausia*. The species may be at once distinguished from *Stylocheiron carinatum* by the more elongate carapace, lacking, as it does, any distinct dorsal crest, by the much smaller eyes, the very slender antennulæ, and a somewhat different structure of the second pair of legs.

Description.—Only three specimens of this form are in the collection, the largest of which, a female, measures 8 mm. in length. The latter, apparently the same specimen examined by the late Dr. v. Willemoes-Suhm, has been treated with carmine and mounted in Canada balsam on a glass slide. The two other specimens, one of which was a male, were more or less defective, and also of smaller size.

The form of the body (see Pl. XXVII. fig. 1) is rather short, and exhibits between the anterior and posterior divisions a proportion somewhat different from that in the preceding species, the tail being relatively far less elongate.

The carapace appears comparatively larger than in *Stylocheiron carinatum*, as also somewhat narrowed anteriorly, and without any distinct crest, being but very slightly keeled along the middle of the anterior part. The rostral projection is shorter, and flattened at the base, terminating in a sharp point, that does not nearly reach to the middle of the basal joint of the antennulæ.

The caudal segments rapidly diminish in height and breadth posteriorly, and are furnished with distinct, though not very large, rounded epimera. The last segment is comparatively short, very little, if at all, longer than the preceding, and would seem to lack the preanal spine.

The eyes (see fig. 1), as in *Stylocheiron carinatum*, are irregularly pyriform, but relatively much smaller, with the cornea exceedingly narrowed in its upper part, forming here (see fig. 4), as it were, a mammillar projection containing a number of densely crowded visual elements.

The antennular peduncle, in the female (see fig. 1), is remarkably elongate and slender, almost equalling the carapace in length, and has the last joint somewhat longer than the second. In the male this part (fig. 4) is relatively less slender, with the outer joints subequal and cylindrical in form. Of the flagella the inner one only is complete in the female specimen; it has nearly the length of the peduncle, and is very slender, with six rather elongate articulations.

The antennal scale (fig. 2) is rather elongate, projecting considerably beyond the second joint of the antennular peduncle, and, in the male (fig. 4), reaching nearly to the tip of the peduncle. It is exceedingly narrow, linear, though slightly expanding toward the apex, which is very obliquely truncate, with the inner corner greatly projecting and the outer having a well-defined tooth. The flagellum is remarkably elongate and slender, exceeding even the length of the body, and has the peduncle extending far

beyond the tip of the scale; the terminal part is composed of about five very long and slender articulations.

The second pair of legs (see fig. 1), when fully extended, almost equal in length the whole body, and have the meral and carpal joints nearly equal. The propodal joint is, as usual, somewhat thickened, and bears at the end of the inner edge three slender, non-ciliated spines. The terminal joint is conically tapering, and juts out as a strong unguiform spine, having also, on either side, two other somewhat shorter ones.

The telson would not seem to exhibit any essential difference from that in the preceding species.

The uropoda, on the other hand, would appear to be relatively shorter, not nearly reaching to the tip of the telson, and with both plates about equal in length.

Habitat.—The three specimens of this form in the collection were taken at the surface of the sea, in the following localities:—

Date.	Locality.
October 27, 1874.	Samboangan to Ilo Ilo, Philippines.
January 9, 1875.	Off Luzon, China Sea.
March 1, 1875.	Pacific, north of New Guinea.

The distribution of the species, as yet known, would accordingly seem to be confined to the western part of the Pacific and the sea surrounding the Philippine Islands.

39. *Stylocheiron longicorne*, G. O. Sars (Pl. XXVII. fig. 5).

Stylocheiron longicorne, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 37.

Specific Characters.—Form of body a little more slender than in the last species. Carapace very slightly keeled above in anterior part; rostral projection shorter than in *Stylocheiron suhmii*, acute. Last caudal segment scarcely longer than preceding. Eyes rather large and much compressed, with cornea very narrow, oblong, but slightly contracted in its upper part. Antennular peduncle remarkably slender and elongate, exceeding carapace in length, both flagella also very long and slender. Antennal scale similar in form to that in *Stylocheiron suhmii*; flagellum enormously produced, with extremely elongate articulations. Second pair of legs likewise of unusual length, longer even, when fully extended, than the whole body, carpal and meral joints subequal, and nearly as in *Stylocheiron suhmii*. Uropoda longer than telson, with inner plate scarcely longer than outer. Length 9 mm.

Remarks.—This species is closely allied to *Stylocheiron suhmii*, but can be readily distinguished by the peculiar compressed form of the eyes, as also by the prodigious length of the antennal flagellum and of the second pair of legs.

Description.—One specimen only of this form, a female, is found in the collection, mounted in Canada balsam on a glass slide. The specimen measures in length 9 mm.

The form of the body (see Pl. XXVII. fig. 5) is somewhat short, though perhaps a trifle more slender than in *Stylocheiron suhmii*, the posterior division being rather more elongate in proportion to the anterior.

The carapace appears relatively smaller than in the last species, exhibiting for the rest a very similar form. The anterior part is slightly keeled above, and juts out as a rather short but acute rostral projection.

The caudal segments are, as in the other species, quite smooth above, and provided with well-defined, though not very large, rounded epimera. The last segment is scarcely longer than the preceding, and would seem to lack the preanal spine.

The eyes are considerably larger than in *Stylocheiron suhmii*, and greatly compressed, expanding at the end, with the cornea remarkably narrow, oblong, and but slightly contracted in its upper part.

The antennular peduncle is exceedingly slender and elongate, more so even than in the last species, and appreciably exceeds the carapace in length. The flagella are somewhat longer than the peduncle, and very slender, filiform, both of them five-jointed and equal in length.

The antennal scale reaches a little beyond the second joint of the antennular peduncle, and exhibits a certain resemblance to that in *Stylocheiron suhmii*, though possibly a trifle broader. The flagellum is prodigiously elongate, perhaps several times as long as the body, the peduncle alone having more than twice the length of the carapace, with the outer joint exceedingly narrow and linear.

The second pair of legs exhibit a structure very similar to that in *Stylocheiron suhmii*, but are relatively still more produced, exceeding, when fully stretched, the whole body in length.

The caudal fan would seem to differ from that of the last species in a more elongate form of the uropoda, projecting appreciably, as they do, beyond the tip of the telson. Both of the terminal plates are about equal in length.

Habitat.—The above described specimen was obtained at the surface of the sea, in the following locality :—

Date.	Locality.
December 14, 1873.	South of Cape of Good Hope.

The species also occurs in the Mediterranean, since a few specimens were taken by myself, at Messina, in the year 1876.

40. *Stylocheiron elongatum*, G. O. Sars (Pl. XXVII. figs. 6–10).

Stylocheiron elongatum, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 38.

Specific Characters.—Form of body very slender and elongate. Carapace somewhat gibbous in anterior part; rostral projection very short. Last caudal segment remarkably elongate, exceeding in length the two preceding taken together. Eyes rather large and compressed, cornea oblong, not contracted in upper part. Antennular peduncle nearly as long as carapace, the two outer joints subequal and but slightly dilated in male. Antennal scale rather narrow, apex obliquely tapering to a projecting corner. Second pair of legs rather shorter than body, meral joint longer than carpal, hand nearly as in the two last species. Inner plate of uropoda much longer than outer. Length of adult male 13 mm.

Remarks.—The present species is recognised at once by the very slender form of the body, and, more particularly, the great length of the last caudal segment. Moreover, the deviating form of the antennal scale, as also the comparatively less elongate second pair of legs, afford good specific characters.

Description.—Two specimens only of this distinct form were found in the collection, one an adult male, the other a young female. The length of the male specimen is 13 mm.

The form of the body (see Pl. XXVII. fig. 6) is more slender and elongate by far than in any of the other species, the tail in particular being greatly produced.

The carapace is comparatively short, measuring in length not more than a third of the tail, and would appear to be somewhat gibbous throughout its anterior part, with a somewhat short and low crest above in the middle. The rostral projection is very short, reaching but slightly beyond the ocular segment. The antero-lateral corners of the carapace are rather produced, and very acute.

The caudal segments taper gradually from before backwards, and are furnished with comparatively small, rounded epimera. The last segment is remarkably elongate and slender, exceeding even the two preceding ones taken together, and would appear to lack the preanal spine.

The eyes are rather large, and expanded toward the apex, but decidedly compressed, with the cornea narrow oblong, and of nearly uniform breadth throughout.

The antennular peduncle in the female specimen is very slender and elongate; that of the male is comparatively more thickset, with the two outer joints somewhat less narrow and about equal in length. The flagella were broken off in both specimens.

The antennal scale (fig. 7) is not very elongate, reaching but slightly (in the male) beyond the second joint of the antennular peduncle, and exhibits a form somewhat dissimilar to that in the other species, being broadest in the middle and tapering gradually towards the apex, which is not truncate, but ends in a projecting corner. The

flagellum was partly broken off in the specimens examined, and innone of them would appear to have had any considerable length.

The second pair of legs (see fig. 6) are relatively much shorter and stouter than in any of the three preceding species, not nearly attaining the length of the body. Of the joints, the meral is appreciably longer than the carpal. The propodal joint (fig. 8) is rather swollen, and has, as in the two preceding species, at the end, interiorly, three curved spines, one of which is very elongate. The terminal joint is conical in form, and bears five spines, three apical and two lateral.

The copulatory appendages of the two first pair of pleopoda in the male (see figs. 9, 10) are rather fully developed, more especially those of the first pair (fig. 9), and exhibit a structure somewhat resembling that in *Stylocheiron carinatum*.

Both the telson and the uropoda appear rather more elongate than in the three preceding species, the inner plate of the uropoda, in particular, being greatly produced, and reaching appreciably beyond the tip of the telson.

The remarkably developed luminous globules occurring at the bases of the penultimate pair of legs are distinctly perceptible in the male specimen (fig. 6) shining through the integument; and, moreover, a supplementary lens may be seen in front of each globule, precisely as in the male of *Stylocheiron carinatum*.

Habitat.—The two above mentioned specimens were taken at the surface of the sea, both in exactly the same locality, along with specimens of *Thysanoëssa gregaria* and *Nematoscelis megalops;* March 1876, South Atlantic.

41. *Stylocheiron abbreviatum*, G. O. Sars (Pl. XXVII. figs. 11–13).

Stylocheiron abbreviatum, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 39.

Specific Characters.—Form of body exceedingly short and thickset. Carapace remarkably shortened, with a slight rounded crest above; rostrum rather large, straight, lanceolate, tip very acute and somewhat deflexed. Last caudal segment longer than preceding. Eyes enormously developed, pedicle very tumid, cornea narrowed in its upper part. Antennular peduncle elongate and slender, the two outer joints subequal. Antennal scale projecting beyond second joint of antennular peduncle, sublinear, apex narrowly truncate, outer corner armed with a very small tooth. Second pair of legs shorter than body, carpal joint only half as long as meral, propodal joint rather elongate, and forming, together with the terminal, a complete chela. Inner plate of uropoda a trifle longer than outer. Length 8 mm.

Remarks.—This species can, at the first glance, be recognised by its very short and thickset body, its enormous eyes, and the peculiar structure of the second pair of legs, the two outer joints of which form together a complete chela.

Description.—Several, but the greater part defective, specimens of this striking form are met with in the collection, the largest of which has a length of 8 mm. All specimens would seem to be females.

The form of the body (see Pl. XXVII. fig. 11) is exceedingly short and thickset, more so perhaps than in any other known species of Euphausiidæ.

The carapace, in particular, is remarkably shortened, almost as high as long, and above has a distinct, though not very elevated, rounded crest. The rostral projection is rather strong, lanceolate, and terminates in a very acute and somewhat deflexed point.

The five anterior caudal segments are somewhat thick, and furnished with comparatively small, rounded epimera. The last segment, on the other hand, is very elongate and tapers toward the apex. Of the preanal spine, no trace whatever could be detected.

The eyes are prodigiously developed, with very thick, and, as it were, swollen pedicles, and the cornea somewhat expanded below but appreciably narrowed in the upper part.

The antennular peduncle is rather elongate, with the two outer joints very slender and about equal in length. Both of the flagella were broken in all the specimens.

The antennal scale (fig. 12) is rather large, reaching to well nigh the middle of the last joint of the antennular peduncle; it exhibits a narrow, linear form, being somewhat curved and narrowly truncate at the apex, with the outer corner projecting as a small denticle. The flagellum is very slender, with its basal part exceedingly narrow and projecting far beyond the tip of the scale, having also the middle joint by far the longest.

The second pair of legs (see fig. 11) do not attain, when fully extended, the length of the body, and have the carpal joint scarcely more than half as long as the meral. The propodal joint, on the other hand, is more produced than in any of the preceding species, attaining well nigh the length of the carpal, and juts out at the end interiorly as a strong unguiform spine. The last joint is digitiform-produced, and terminates in a strong incurved claw, bearing at its base two secondary spines. This joint, too, admits of being impinged against the spine arising from the preceding joint, and thus constitutes with the latter a complete chela, in appearance somewhat resembling that in several Decapods.

The caudal fan does not exhibit any marked peculiarities. The inner plate of the uropoda is, however, somewhat longer than the outer, and projects a little beyond the tip of the telson.

Habitat.—The specimens were taken at the surface of the sea, in the following localities :—

Date.	Locality.
July 1875.	Pacific, north of Sandwich Islands.
April 9, 1876.	Tropical Atlantic.
April 29, 1876.	North Atlantic.

Hence the species would seem to have a rather extensive distribution, ranging, as it does, from the North Atlantic to the Pacific Ocean.

DEVELOPMENT OF EUPHAUSIIDÆ.

In his great work on the Crustacea of the United States Exploring Expedition, Dana has established, exclusive of certain other spurious genera, apparently founded on larval forms of Macrura, the three following schizopodous genera:—*Cyrtopia*, *Furcilia*, and *Calyptopis*. The first of these he ranks among the Euphausiidæ, whereas the two others are described in an Appendix to the Mysidæ together with the spurious genus *Zoëa* (first larval stage of Brachyura). As first shown by Professor Claus,[1] all these three genera represent but different stages in the development of Euphausiidæ, the genus *Calyptopis* being an earlier, the genus *Cyrtopia* a later, and the genus *Furcilia* an intermediate stage. In 1869 Metschnikoff described[2] a still earlier stage in the development of *Euphausia*, and in 1871 the same author stated[3] that the young of *Euphausia* are hatched as true Nauplii, having a rounded, unsegmented body with only three pairs of developed limbs, viz., the two pairs of antennæ and the so-called mandibular legs. Thus not less than five principal stages occur in the larval development of the Euphausiidæ. The two first we shall designate, in accordance with earlier authors, the *Nauplius* stage and the *Metanauplius* stage. For the three succeeding stages I have seen fit to apply the generic denominations suggested by Dana, since none of these stages fully correspond with the *Zoëa* and *Mysis* stages in other Podophthalmia. Hence we have the following successive stages in the development of the Euphausiidæ. The *Nauplius*, *Metanauplius*, *Calyptopis*, *Furcilia*, and *Cyrtopia* stages .The first of these I have not had opportunity of examining, whereas the following will all be found described in detail below, as well as several intermediate or connecting stages.

I append here a short diagnosis of each of the principal stages peculiar to the development of the Euphausiidæ:—

1. *Nauplius Stage.*—Body oval, unsegmented. No compound eyes. Three pairs of

[1] Ueber einige Schizopoden und niedere Malacostraken Messina's, *Zeitschr. f. wiss. Zool.*, 1863.
[2] Ueber ein Larvenstadium von Euphausia, *Zeitschr. f. wiss. Zool.*, Bd. xix.
[3] Ueber den Naupliuszustand der Euphausia, *Zeitschr. f. wiss. Zool.*, Bd. xxi.

limbs only present, the anterior (antennulæ) simple, the two others (antennæ and mandibular legs) biramous, natatory.

2. *Metanauplius Stage.*—Form of body as in the Nauplius stage. Two pairs of limbs (antennulæ and antennæ) only developed; mandibular legs lost. Mandibles, maxillæ, and maxillipeds present merely as bud-like prominences.

3. *Calyptopis Stage.*—Body divided into its two principal divisions. Carapace distinct, forming anteriorly a hood-like expansion. Tail becoming segmented. Compound eyes still imperfectly developed, immobile, and covered over by the carapace. Mandibles, maxillæ, and maxillipeds distinct, but no trace of legs or pleopoda. Uropoda becoming developed.

4. *Furcilia Stage.*—Compound eyes more fully developed, mobile, and projecting beyond the sides of the carapace. Antennæ still retaining their original structure, natatory. Anterior pairs of legs and pleopoda successively developing.

5. *Cyrtopia Stage.*—Antennular flagella becoming elongate and distinctly articulate. Antennæ transformed, so as not to serve the purpose of locomotion. Posterior legs and gills successively appearing.

6. *Post-Larval Stage.*—All the legs developed. Telson assuming its definitive form and armature.

The difficulty attending an accurate reference of the numerous larval forms contained in the Challenger surface gatherings to the several species described above has been very great. However, by carefully examining all the forms, and comparing one with the other, I have nevertheless been enabled to trace out the development, more or less completely, in four different species belonging to as many genera. In the following pages I purpose describing the several stages of each species in detail.

Early Larval Stages of Nyctiphanes australis, G. O. Sars (Pl. XXVIII.).

The larvæ treated of here I have felt warranted in referring to the above-named species, taken, as they were, from precisely the same bottles as the adult specimens of this form, and from localities where no other Euphausiidæ were obtained. Moreover, as stated above, two of the adult females were ovigerous, whence it may be inferred that hatching time was about to commence. From this cause, apparently, no older larval stages than those here described were found in the jars.

Metanauplius Stage (figs. 1–3).—This is the earliest stage known to the author, and that, it would seem, immediately succeeding the true Nauplius stage. It was represented by a solitary specimen, which measured only $\frac{1}{2}$ mm. in length.

The body is oval in form and does not exhibit the slightest trace of segmentation, nor any distinct limitation of the two principal divisions, so well defined in the adult animal.

The carapace is, however, distinctly indicated even at this early stage, forming, as it

were, an evenly arched clypeiform shield, that covers about the whole of the body, except a small obtusely conical part jutting out behind, and representing the rudimentary tail. It constitutes in the greater part of its extent the immediate wall of the body, being free only in its marginal zone, where it forms merely a slight fold, covering at the sides the bases of the budding limbs back to the oral opening.

Of the compound eyes, no trace whatever can be detected. Only a small spot of black pigment is observed anteriorly on the median line, and somewhat ventrally, representing the simple larval eye, or ocellus, which, as stated above, also occurs in the adult animal between the insertion of the compound eyes.

Posterior to the ocellus, and between the points of insertion of the antennæ, may be seen inferiorly a rather large carneous prominence, continuous anteriorly with the front part of the body, whereas, posteriorly, it ends as a free, arcuate edge. This prominence represents the anterior lip, arching partly over the oral aperture.

The posterior lip, on the other hand, is in this stage quite rudimentary, forming simply two slight transverse prominences (see fig. 3), which do not as yet mark off the oral aperture posteriorly, but lie at a considerable distance behind it, between the budding maxillæ.

Of limbs, only two pairs occur fully developed, representing the antennulæ and antennæ, both of which, but especially the latter, serve as natatory organs.

The antennulæ spring from the ventral face of the body at a short distance from its anterior extremity, and point, as a rule, straight forward. They consist of a slender non-articulate stem, about half the length of the body, curving slightly outward at the extremity, which tapers to an obtuse point and bears a few slender setæ, one of which is rather elongate.

The antennæ, originating at a short distance posterior to the antennulæ, are exceedingly mobile, and constitute the chief locomotive organs, by the powerful strokes of which the little animal is rapidly propelled through the water. They are of nearly the same length as the antennulæ, but rather dissimilar in structure, consisting of an indistinctly biarticulate and somewhat curved basal part, or stem, from the end of which spring two narrow cylindrical branches of equal size, provided at the tip with several slender and delicately ciliated setæ.

In addition to the parts described above, occur, along the ventral face of the body, four pairs of rounded transverse prominences, arranged symmetrically on either side, and separated in the middle by a narrow interstice. These prominences, very soft in consistence, and densely cellular in structure, represent the first traces of as many limbs, viz., the mandibles, the two pairs of maxillæ, and the maxillipeds. None of them, however, exhibit as yet the slightest trace of segmentation, or any armature of spines or bristles, forming merely simple buds of the body-wall.

The anterior pair of these buds, the mandibles, lie immediately behind the points of

insertion of the antennæ, on either side of the free edge of the anterior lip, separated as yet in the middle by a rather broad interstice. They are comparatively small, elliptical in form, and, on the outer side, drawn out to a conical point, the rudiment of the powerful biramous mandibular legs occurring in the Nauplius stage.

The three succeeding pairs lie in close contact with each other, forming rather broad transverse intumescences, which, at the inner corner, jut forth as rounded, somewhat posteriorly pointing lobes, double on the last pair (the maxillipeds).

The part of the body posterior to the above described parts, constituting the rudiment of the tail, is quite smooth, and somewhat flattened at the extremity, which is broadly truncate, with a very faint emargination in the middle. On either side of the emargination three very short spines are seen to arise from the edge.

First Calyptopis Stage (figs. 4–19).—The body has in this stage a length of about 1 mm., and exhibits (see figs. 4, 5) a more distinct limit between an anterior and a posterior division, the latter being, however, as yet much shorter than the former.

The carapace is now more fully developed, with the free portion broader, mantling over, as it were, the bases of the limbs, and forming anteriorly a hood-like expansion, that covers from above the anterior extremity of the body. The free edges are quite smooth and evenly curved, without teeth or projections, forming, however, a slight incurvation at the sides of the buccal area.

The posterior division of the body lacks as yet every trace of segmentation, constituting merely a simple, cylindrical projection, generally bent at a more or less distinct angle. It is, however, rather mobile, and admits, by the aid of a well-defined assemblage of muscles adjoining it on the upper face, of being stretched in nearly the same axis as the anterior division. At the extremity it is somewhat flattened and abruptly truncate, and has the terminal edge (see fig. 19) armed with a row of twelve strong ciliated spines, the six median about equal, the outer three on either side rapidly increasing in length to the innermost, which is very large and projected far beyond the rest. Besides the above-mentioned terminal spines a pair are seen arising from the ventral face at some distance from the extremity, each of the spines originating a little within the lateral edge.

Immediately in front of the posterior division of the body may be observed a faint and close wrinkling of the integument as a first indication of the segmentation of the trunk (see fig. 6).

The ocellus is distinctly perceptible, placed in the middle line at some distance from the anterior margin of the carapace (see fig. 6). When highly magnified (fig. 7) it is found to contain two small refracting bodies protruding from the pigment anteriorly.

On either side of the ocellus, and somewhat dorsally, occur beneath the hood-like expansion of the carapace (see figs. 4, 5) two large cellular bodies, of a somewhat compressed, semicircular shape, but as yet, however, comparatively indistinctly defined.

These bodies represent the first indication of the compound eyes; but neither pigment nor any trace of visual elements have appeared. All that can now be seen within these corpuscles consists of a bunch of densely crowded, glistening posteriorly diverging fibres, easily recognised as representing the peculiar luminous organ that occurs in the pedicles of the eyes of the adult animal.

The antennulæ (fig. 8) still constitute simple, somewhat curved stems, tapering toward the apex, but differ from those in the preceding stage in the apical part being marked off from the remainder as a distinct terminal joint, representing the outer flagellum. This joint juts out interiorly as a small denticle, bearing, moreover, at the tip, three slender bristles, and two translucent sensory appendages of unequal length. Of the inner flagellum, no trace has yet appeared, its place being occupied merely by two bristles springing from the end of the basal section or peduncle.

The antennæ (fig. 9) have the two segments of the basal part more distinctly defined, the distal segment being somewhat shorter than the proximal, and slightly dilated toward the end. The terminal branches, too, appear more fully developed and nearly as long as the basal part. The inner branch is simple cylindrical and non-articulate, bearing at the end four very long ciliated setæ and at the inner edge two smaller ones, the proximal setæ, very short and spiniform. The outer branch, on the other hand, has the apical part rapidly tapering, and divided into several (about five) very short articulations, provided at the inner edge with slender natatory setæ, successively diminishing in length toward the apex.

The anterior lip (see figs. 6 and 10) has become more distinctly marked off from the body-wall, forming a rather large oboval prominence, the posterior edge of which covers over the inner part of the mandibles.

The posterior lip (fig. 11) exhibits quite a normal aspect, its lobes being irregularly rounded and delicately ciliate along the inner edge.

All the three ventral limbs—in the preceding stage but faintly indicated—have now become active organs for conveying food to the mouth; hence they are mobile and armed with bristles and spines (see fig. 6).

The mandibles (see figs. 10, 12) have the inner (masticatory) part expanded in the usual manner, and exhibit, moreover, anteriorly an acute projection arising, it would seem, from the point where, in the Nauplius stage, the mandibular leg originates. Of a palp, on the other hand, no trace whatever can be found. The armature of the cutting edges (see figs. 13, 14) is well developed, though somewhat dissimilar to that in the adult animal, resembling rather the armature found in some Mysidæ. As occurs in the latter, the anterior part is divided into several strong and very closely arranged teeth, forming together two partly superposed portions, which in the two mandibles exhibit a somewhat different shape. Between this dentate part and the molar protuberance occurs a short dentiform projection, and at the base of the latter is affixed on both mandibles a very

peculiar narrow plate, somewhat expanded at the extremity, and having the apical edge finely denticulate. This plate (fig. 15), wanting entirely in the adult animal, would appear to be movably connected with the mandible, since it is very easily disengaged.

The first pair of maxillæ (fig. 16) exhibit all the parts observed in the adult animal, though they are of a somewhat dissimilar form and armature. Of the two masticatory lobes, the inner lobe is linguiform, and furnished with eight strong ciliate bristles, whereas the outer is truncate at the extremity, and armed with only two thick, digitiform spines ciliate at the tip, exclusive of a simple bristle originating between the spines. The terminal joint or palp is oval, not constricted at the base, and provided with six bristles, three of which spring from the tip, and three from the inner edge. The exognath is very small, forming only a minute knob-like projection furnished with four strong ciliate setæ, one very long and reflexed, whereas the three others are directed anteriorly.

The second pair of maxillæ (fig. 17) present a more deviating appearance, being rather narrow, with the inner edge divided into five small rounded lobes, provided with long ciliate setæ. The terminal joint is lamellar, and oblong in form, and bears at the rounded tip four curved setæ. Of a distinct exognath no trace can be found, the outer edge of the basal part being not in the least expanded, and furnished only at the distal part with a single ciliate bristle.

The maxillipeds (fig. 18) are in appearance totally different from those in the adult animal, having more properly the character of maxillæ than of legs. They consist of a rather broad and flattened basal part, divided into two distinct segments, and of two short terminal branches, the inner representing the endopodite, the outer the exopodite. The two segments of the basal part (the coxal and basal joints) have their inner edges somewhat expanded and setiferous, four slender ciliate setæ springing from the proximal segment, and four shorter ones from the distal. Moreover, a minute spine occurs between the two outermost setæ of the distal segment. The endopodite scarcely exceeds half the length of the basal part, and consists of two well-defined joints; the proximal is broader than long, and bears at the inner edge a short spine and a ciliate bristle, whereas the distal joint is ovate, and provided at the tip with four slender curving setæ. The exopodite is about the same size as the endopodite, but consists of only a single oblong joint, bearing four slender apical setæ. Of an epipodite, no trace whatever can be detected.

No other limbs are as yet developed, and, with the exception of the antennulæ and antennæ, they all serve, as true oral organs, for conveying food to the mouth.

Second Calyptopis Stage (figs. 20–22).—In this stage the larva has a length of $1\frac{1}{2}$ mm., and is chiefly distinguished (see fig. 20) by a more perfect development of the tail, which has now fully attained the length of the carapace, and is also divided into seven distinct segments. The last of these, representing the telson (fig. 22), is somewhat spathulate at the end, and exhibits along the edge an armature similar to that in the preceding stage, except only that an additional spine has appeared in the middle of the apical edge, and

somewhat shorter than the rest. Beneath the outer integument can be faintly traced at the base of the telson two oval plates, the budding uropoda.

The cellular masses, representing the compound eyes, are somewhat more distinctly defined, and exhibit the fascicle of luminous fibres unaltered, whereas in the anterior part a small pigmentary spot has appeared, the first trace of the ocular pigment.

The antennulæ (fig. 21) have now become divided into a cylindrical, triarticulate peduncle, and two rudimentary flagella, the outer of which represents the terminal joint of the antennulæ in the preceding stage, whereas the much smaller inner flagellum has appeared in the present stage.

In the structure of the other limbs no difference can be observed from that in the preceding stage.

Third Calyptopis Stage (figs. 23–26).—This stage corresponds very nearly with the earliest stage of *Euphausia*, as figured by Professor Claus. The animal measures 2·20 mm. in length, and has (see fig. 23) the tail still more developed, appreciably exceeding the carapace in length.

The eyes, still completely covered over by the hood-like anterior expansion of the carapace, are almost globular, and exhibit, besides a somewhat more extensive accumulation of pigment, also the first faint trace of visual elements.

The antennulæ (fig. 24) are more powerfully developed, and from the outer corner of the basal joint juts forth a strong, anteriorly pointing spine, denticulate along the inner edge.

The other limbs belonging to the anterior division have remained nearly unaltered, with this exception, that the outer masticatory lobe of the first pair of maxillæ (fig. 25) has a greater number of spines, viz., five.

At the base of the telson (see fig. 26) the uropoda have developed, but are still very small and without any marginal setæ, exhibiting, however, their two terminal plates though not yet defined from the basal part. Of these, the outer is much the larger, and juts out at the end exteriorly as a strong spine, whereas the inner plate is very small and merely papillar in form.

No trace whatever either of legs or pleopoda can as yet be detected.

Of the inner organs in this and the preceding stages but little can of course be observed in the spirit-specimens. Having, however, thoroughly examined in this respect corresponding stages of the northern species, *Nyctiphanes norvegica* (M. Sars), in a living state, I am enabled to confirm the correctness of the statements respecting the inner organisation of the larvæ given by Professor Claus in his above quoted treatise.

Development of Euphausia pellucida, Dana (Pls. XXIX., XXX.).

Of this form, the most frequent of all the Challenger Euphausiidæ, numerous larvæ in different stages of development were found in the surface-gatherings sent me for

examination, and thus I have been enabled to trace the development of this species through all its numerous successive stages comprised between the second Calyptopis stage and the adult form. Of still earlier stages, on the other hand, no examples were found in the collection, and hence I have deemed it advisable to treat of the development of the present form next after *Nyctiphanes australis*, of which the earliest larval stages found have been described above.

With a view to show the progressive development of the several limbs, I have carefully dissected specimens of all the stages here described; and in Pl. XXX. series of figures of the same limbs, in different stages of development, have been given. I first propose to describe in general the more marked stages, and then shall pass on to a detailed investigation of the chief modifications the limbs undergo during development.

A. *General Description of the successive Larval Stages* (Pl. XXIX.).

Second Calyptopis Stage (figs. 1, 2).—From the corresponding stage of *Nyctiphanes australis*, this is easily recognised by the spine-like projection formed by the carapace posteriorly, as also by the anterior margin of the hood-like frontal part being finely denticulate. Moreover, the terminal segment of the tail (telson) would appear to be somewhat more produced and slightly deviating in its armature. In all other respects the larva closely resembles the corresponding stage of *Nyctiphanes*. Length of body $1\frac{1}{2}$ mm.

Last Calyptopis Stage (fig. 3).—This is precisely the same stage figured by Professor Claus in his treatise referred to above. It corresponds to the last described larval stage of *Nyctiphanes*, from which, however, it differs, in addition to the characters distinguishing the former stage, by the presence, on either side, of a well-marked lateral denticle projecting from the lower margin of the carapace posterior to the middle. Length of body 2·20 mm.

First Furcilia Stage (figs. 4, 5).—The most prominent feature distinguishing this stage from the two preceding ones, is the pronounced development of the compound eyes, which have now become mobile and freely projecting beyond the edges of the carapace, instead of, as in the Calyptopis stages, being immobile and hidden beneath the hood-like frontal part of the carapace. In accordance therewith, the anterior part of the carapace is somewhat altered, a distinct emargination having appeared on either side, limited beneath by an acute angle (the antero-lateral corners), and marking off in the middle a broad frontal plate arching over the basal part of the eye-pedicles and the antennular peduncles (see fig. 5). This plate has a somewhat cordiform shape, being slightly produced in the middle, and having the lateral edges evenly curved and finely denticulate.

As regards the limbs, the antennulæ, the antennæ, the mandibles, the two pairs of maxillæ, and the maxillipeds are nearly of the same appearance as in the preceding stage. Now, however, the first trace of two additional pairs of limbs have made their appearance, the one occurring immediately behind the maxillipeds and representing the first pair of legs, the other placed on the first caudal segment and representing the first pair of pleopoda. Meanwhile, both have still the character of simple, non-articulate, conical processes, without exhibiting the slightest trace of bristles or any other form of armature. Moreover, the uropoda have increased somewhat in size, and the terminal plates have become distinctly defined from the basal part, and furnished at the tip with a few slender setæ. The length of the larva in this stage is 2·65 mm.

Intermediate Furcilia Stage (fig. 6).—In this stage the carapace has lost its posterior spiniform projection, and the frontal plate has become narrower and more pointed. The two additional limbs mentioned above, and forming, in the preceding stage, merely simple non-articulate processes, have become more fully developed, being distinctly articulate and provided with a few setæ, and the first pair of pleopoda are even, in living specimens, found to act as swimming organs. In addition, several other budding limbs may be observed, viz., immediately posterior to the newly formed first pair of legs, the first trace of the following (second) pair of legs, and on each of the four medial caudal segments a pair of small conical processes, representing the corresponding pleopoda. Moreover, three of the luminous globules have made their appearance, viz., the foremost pair on the trunk, lying within the coxal joints of the first pair of legs, and the most anterior of the odd globules belonging to the tail. The telson and uropoda, finally, have slightly altered in form, the former being now somewhat narrower, and the latter a trifle more produced. Length of the larva 3·20 mm.

Last Furcilia Stage (fig. 7).—In this stage all the pleopoda have become developed, and act in the living animal as true swimming organs. On the trunk the second pair of legs have become articulated, though they are still much smaller than the first, and behind it a few minute bud-like projections may be seen, apparently representing two additional pairs of legs, besides the first trace of the gills. The antennæ until now have retained their original form and function unaltered, acting as powerful natatory organs, but in some specimens belonging to this stage the long plumose setæ are found to be partly obliterated, thus proving their original function as swimming organs to be nearly finished. The frontal plate of the carapace has lost its marginal dentition, and is very narrow, assuming accordingly a form more in relation with that of the adult animal. Length of the body 3·60 mm.

First Cyrtopia Stage (fig. 8).—The character distinguishing most prominently this stage from those preceding it, is the total change in structure and function of the antennæ. These limbs now cease entirely to act as swimming organs, and hence have lost their great mobility, being now invariably extended forwards, and not, as in the

preceding stages, sideways. Of the two branches, the one has assumed the character of the scale, the other of the flagellum. Both flagella of the antennulæ have become considerably elongated and divided into distinct articulations. The two anterior pairs of legs are more fully developed and nearly equal in size, both having acquired the geniculate bend characteristic of the adult animal. Posterior to these, another pair of legs have developed, and the gills are distinctly visible, though still exhibiting a very simple structure. The hindmost pair of luminous globules on the trunk have just appeared, and on the tail all the globules are quite distinct. Length of body 3·80 mm.

Last Cyrtopia Stage (fig. 9).—In this stage the flagellum of the antennæ has increased considerably in length, and its basal part is clearly defined from the terminal part. On the trunk occur three pairs of distinctly developed, geniculate legs, and behind them another much smaller pair have made their appearance. The endopodite of the maxillipeds is somewhat prolonged, and has a more pronounced pediform appearance. Finally, the gills are somewhat more complex in structure than in the preceding stages. Length 4·15 mm.

First Post-Larval Stage (fig. 10).—The full number of legs is now developed, and the animal, on the whole, exhibits all the characters distinguishing the adult form, except that the flagella of the antennulæ and antennæ have not yet attained their full length, that the gills are still comparatively simple in structure, and, finally, that the anterior pair of the lateral denticles of the carapace are not yet developed. Length of the animal in this stage about 5 mm.

B. *Development of the several Appendages of the Body* (Pl. XXX.).

The Compound Eyes (fig. 9).—In the Nauplius and Metanauplius stages these organs are entirely wanting, as shown to be the case in the last of these stages in *Nyctiphanes*. In the Calyptopis stages they are still very imperfectly developed, forming immobile rounded masses, wholly covered by the carapace and devoid of any distinctly developed visual elements. In the last only of these stages a faint trace of the ocular pigment and a few radiating stripes may be seen in the anterior part of the eyes. Not till the Furcilia stages do the organs (fig. 9) become mobile and pedunculate, as also freely projecting towards either side. The cornea has become formed, but its areolation is still imperfect, and the visual elements, radiating from the ocular pigment, are unequally developed, those in the middle being still quite rudimentary. The luminous ascicle, distinct in the earliest stages, has now a narrow ring of red pigment coating on the base. The following development of the eyes proceeds quite gradually, and as early as the Cyrtopia stages, they exhibit much the same appearance as in the adult animal, though comparatively smaller and less expanded at the tip.

The Antennulæ (figs. 1–5).—These limbs, constituting in the Nauplius and Metanauplius stages simple, non-articulate stems, exhibit each of them (fig. 1) in the earliest Calyptopis stage described above, and apparently corresponding to the second Calyptopis stage of *Nyctiphanes*, a slender non-articulate peduncle, bearing at the apex two very small, uniarticulate flagella, the outer a little longer than the inner, and provided with a pair of slender bristles and two sensory appendages.

In the following (last) Calyptopis stage, these limbs (fig. 2) are much more fully developed, the peduncle being rather strong, and divided into three distinctly defined joints, of which the basal is by far the largest, and projects at the end exteriorly as a strong spine, denticulate at the inner edge, and reaching almost to the end of the peduncle. The second joint is quite short, and bears at the inner edge two strong ciliate setæ. The last joint is almost twice as long, and has a single bristle internally. The flagella do not exhibit any essential difference from those in the preceding stage.

In the Furcilia stages the number of bristles along the inner edge of the peduncle has become somewhat augmented, and the two flagella have slightly increased in length, though still uniarticulate. In the last of these stages (see fig. 3) the long apical bristles of the flagella are lost, and the two sensory appendages of the flagellum, arising originally from the tip, are now affixed to a ledge-like projection of the inner edge, near the base.

In the Cyrtopia stages the peduncle (fig. 4) has a somewhat greater similarity to that of the adult animal, the spine springing from the basal joint being somewhat reduced in size, and both the flagella considerably elongated and divided into a number of distinctly defined articulations.

But not till the last stage described above—the first post-larval stage—do the antennulæ (fig. 5) assume their definitive form, differing only from those of the adult animal in the dorsal leaflet of the basal joint being still but slightly indicated, and in the flagella having not yet attained their full length.

The Antennæ (figs. 6–8).—The structure of these limbs is much the same throughout all the Calyptopis and Furcilia stages. They differ widely from those in the adult animal both in form and function, constituting, as they do, very mobile, biramous natatory organs of much the same appearance as that described above in the larvæ of *Nyctiphanes*, and strongly reminding one of the second pair of antennæ in the Calanoid Copepoda.

In the last Furcilia stage some of the natatory setæ are sometimes, however, found to be obliterated (see fig. 6), though in other respects no difference in the structure of the organs has yet arisen.

But in the next, or first Cyrtopia stage, these organs (fig. 7) are seen to have suddenly undergone a total alteration alike in structure and function, having lost their great mobility, and assumed a form more in accordance with that of the adult animal. The basal part is shortened and has lost its segmentation, whereas a slender spine has sprung from the end externally, representing the basal spine of the adult animal. Of

the two branches, originally nearly similar in structure, the outer has assumed the character of an oval scale, fringed along its inner edge and apex with a regular series of slender bristles, whereas the inner branch has retained its cylindrical form, though somewhat produced and divided into a biarticulate peduncle, and a non-articulate, naked, and digitiform, terminal part, forming together the flagellum.

In the next Cyrtopia stage the flagellum becomes still more produced. But not till the first post-larval stage does it assume (fig. 8) its definitive structure, the peduncle being then triarticulate, and the terminal part subdivided into a number of distinctly defined short articulations, furnished with minute bristles.

The Mandibles (figs. 10–12).—Also these organs exhibit no change whatever through most of the larval stages, retaining (fig. 10) the peculiar armature of their cutting edges, as described above in the larvæ of *Nyctiphanes*, and also the spiniform projection occurring at the base of the masticatory part anteriorly. Of a palp no trace whatever can be detected previous to the Cyrtopia stages, when a very small and soft knob-like projection first appears on the outer face of the mandibles, at the base of the masticatory part. This process becomes, in the second Cyrtopia stage, somewhat more elongate (see fig. 11), but is still non-articulate and naked. Finally, in the first post-larval stage, the palp (see fig. 12) has become considerably produced, and divided into three distinct articulations, the two outer of which bear each a single bristle. In this and the two preceding stages, moreover, the peculiar supplementary plate of the cutting edge, described above in the larvæ of *Nyctiphanes*, and also occurring in the larvæ of *Euphausia*, would appear to be entirely lost.

The First Pair of Maxillæ (figs. 13–15).—The appearance of these maxillæ in the larvæ previous to the Cyrtopia stages (fig. 13) is much the same as that described above in the larvæ of *Nyctiphanes*, with this exception, however, that the palp is distinctly biarticulate. In the Cyrtopia stages, however, the palp becomes uniarticulate, its two original joints being fused together (see fig. 14), and at the same time it assumes a somewhat oval form, still more pronounced in the following stage—the first post-larval (see fig. 15). In the latter stage, too, the true exognath makes its appearance, originating, apart from the larval exognath, in the form of a thin elliptical lamella bearing only a single bristle at the tip. The larval exognath, with its four strong setæ, is still found in this stage beneath the newly formed lamellar exognath, but in the following entirely disappears.

The Second Pair of Maxillæ (figs. 16–18).—Also these maxillæ exhibit scarcely any change throughout the true larval stages, their structure (fig. 16) being very similar to that described above in the larvæ of *Nyctiphanes*. The first perceptible alteration is observed in the last Cyrtopia stage, when a new setæ has developed behind that affixed to the end of the basal part exteriorly (see fig. 17). In the succeeding stage (first post-larval) three more setæ are added (see fig. 18), constituting, along with the two

others, a regular series along the outer edge of the basal part, which appears here a little expanded, thus representing the first rudiment of the lamellar exognath. The terminal joint, or palp, in this stage is now considerably expanded, and assumes a form more in accordance with that of the adult animal, though still provided with only three setæ. In the following stages, however, the number of setæ gradually increases, and the short spiniform bristles, characteristic of the present species, make their appearance, only a single one being at first developed.

The Maxillipeds (figs. 19–22).—In the Calyptopis and Furcilia stages these limbs retain their original structure (see fig. 19) almost unchanged, agreeing precisely with that of the larvæ of *Nyctiphanes*, as described above. In the last Furcilia stage, however, a very slight elongation of the endopodite can be traced, and in the first Cyrtopia stage this part (see fig. 20) has become triarticulate, the middle joint being rather elongate and exhibiting a slight trace of a median constriction, whereas the apical joint is very small. In the last Cyrtopia stage the endopodite (see fig. 21) is still more produced and distinctly four-jointed, and, finally, in the first post-larval stage this part (see fig. 22) has become quite pediform and composed of five distinctly defined joints. The exopodite in the same stage shows an incipient division into two principal parts, viz., the basal and terminal, the division, however, being not yet fully complete.

The Legs (figs. 23–27).—The first trace of these limbs is found in the first Furcilia stage, a pair of small simple processes (fig. 23) then appearing just behind the maxillipeds. These processes, representing the first pair of legs, rapidly increase and give origin, at their outer side, to a small lateral knob, the first appearance of the exopod (see fig. 24). In the intermediate Furcilia stage, represented in Pl. XXIX. fig. 6, the endopod (fig. 25) has already become distinctly articulated and provided with a few small bristles. Moreover, in this stage the luminous globule, imbedded in the coxal joint, is faintly seen, as also the first trace of the corresponding gill. In the last Furcilia stage these legs (fig. 26) are quite pediform, the endopod being rather produced and five-jointed, and in the Cyrtopia stages (fig. 27) they assume more and more the structure characteristic of the adult animal, until, in the first post-larval stage, they merely differ by reason of the somewhat smaller number of marginal bristles.

The second pair of legs are found in the intermediate Furcilia stage, budding forth behind the first in precisely the same manner as that pair; and the following pairs make their appearance successively in the next stages, until, in the first post-larval stage, all the five pairs present in the adult animal are fully developed, the last, however, being still very small.

The Gills (figs. 28–32).—As previously stated, the first trace of these organs occurs as early as the intermediate Furcilia stage described above, but merely as inconspicuous simple knob-like projections at the bases of the budding legs (see fig. 25). In the last

Furcilia stage (fig. 28) four pairs of gills have made their appearance, of which the anterior three are now bifurcate (see also fig. 26), the last pair simple. In the following stage (first Cyrtopia stage) six pairs may be seen (fig. 29), the three anterior being still bifurcate, whereas the next pair are very small and knob-like; and of the two last pairs, the anterior are bifurcate, the posterior simple. At the base of the former occurs a rounded expansion, within which a luminous globule has appeared, and hence these two pairs are found in reality to represent the two last pairs in the adult animal. The antepenultimate pair are of course not yet developed, nor is any trace of the corresponding legs as yet perceptible. In the last Cyrtopia stage (fig. 31), however, all the gills have developed, the four anterior pairs being bifurcate, the fifth simple, the penultimate quadripartite, and the last tripartite. Finally, in the first post-larval stage (fig. 32) the third and fourth pairs have become tripartite, the fifth bifurcate, and the two last pairs respectively quinque- and sex-partite. During the progressive growth of the animal the gills gradually acquire a more complex structure, the two last pairs in particular becoming rapidly larger and more distinctly arborescent.

The Pleopoda (figs. 33–35).—The development of these limbs does not commence till the Furcilia stage, and proceeds successively from before backwards. In the first of these stages a pair of small bud-like processes are seen springing from the ventral face of the first caudal segment. When isolated and strongly magnified, these processes (fig. 33) exhibit a somewhat lanceolate form, and have on the inner side a very small projection—the first trace of the inner plate. In the stage occurring between the two first Furcilia stages described above, similar bud-like processes successively appear on the following three caudal segments. In the intermediate Furcilia stage, figured in Pl. XXIX. fig. 6, the penultimate segment has also acquired a similar pair of buds, and those belonging to the first caudal segment have now attained a more complete development (fig. 34), being composed of a distinctly defined basal part and two terminal plates, the outer of which is much the larger, and furnished with six natatory setæ, whereas the inner is very small, conical in form, and bears a single apical seta only. The other pleopoda now successively acquire a similar structure, while the anterior pair develop further (fig. 35), their inner plate becoming more complete, acquiring at first an additional seta springing from the outer edge, as also a small projection at the inner edge, representing the secondary lobe occurring in the adult animal. The following development proceeds successively from before backwards, till finally all the pleopoda have acquired their definite form.

The Telson (figs. 36–42).—This part undergoes a constant change during the several stages of development, being at first very broad and spathulate in form, and becoming successively narrow until at last it assumes the slender spine-like form characteristic of the adult animal. This change is also, as will appear in the sequel, accompanied by a

remarkable alteration in the armature, most of the spines observed in the larval telson at length wholly disappearing, and a few only being left to acquire the peculiar form characteristic of those in the adult animal.

In the earliest Calyptopis stage described above, the telson (fig. 36) is not yet defined from the last caudal segment. It constitutes a broad spathulate plate, constricted a little posteriorly to the middle, and armed on either side with a strong lateral spine. The end is somewhat expanded and broadly truncate, and its terminal edge fringed with a row of thirteen strong ciliated spines. Of these, the median is very small, the three succeeding ones on either side being somewhat larger and uniform in size. The three outermost spines on either side, occupying the rounded lateral corners, are much stronger than the rest, and the middle one by far the largest, projecting considerably beyond the others.

In the last Calyptopis stage the telson (fig. 37) is distinctly defined from the last caudal segment by a well-marked suture, and at its base the uropoda have developed. The form and armature of the telson do not, however, differ materially from those in the preceding stage.

In the first Furcilia stage the telson (fig. 38) has become somewhat narrower in proportion to its length, and the median of the terminal spines has attained the size of those succeeding it on either side, all forming together an uninterrupted row of seven uniform and comparatively short spines occupying the median part of the terminal edge.

In the intermediate Furcilia stage the telson (fig. 39) is considerably narrower than in the preceding stages, though still somewhat expanded towards the end, which has assumed a broadly rounded form, the middle part, bearing the seven small spines, being somewhat protruded. Of the three outer spines, the innermost has become remarkably strong, though still shorter than the middle one, and the cilia at its inner edge are coarser and more dentiform.

In the last Furcilia stage the telson (fig. 40) is almost linear, being scarcely at all expanded at the end. The middle part of the extremity protrudes considerably, being, however, still truncate at the tip, and bearing the original number of spines (seven), which are very small and densely crowded together. Of the outer spines, the innermost has still more increased in size, being almost as long as the middle one and much thicker, whereas the outermost spine has diminished in size.

In the first Cyrtopia stage the telson (fig. 41) is very narrow, linear, and the middle part of the extremity juts forth as a conical process, bearing at its narrow truncate tip only three spines, four of the original ones having disappeared. The innermost of the outer spines, on either side, is now very large and sharpened at the inner, strongly denticulate edge, as also distinctly projecting beyond the others.

In the last Cyrtopia stage the telson (fig. 42) has nearly assumed its definitive form, being somewhat incrassate at the base and slightly tapering towards the apex,

which juts out as a lanceolate pointed projection, all the original spines affixed to this part in the earlier stages having disappeared. The three outer spines on either side of this projection are still present in this stage, and the innermost of these spines is very large and has already assumed the form characteristic of the subapical spines in the adult animal, whereas the outermost is exceedingly small and easily recognised as representing the posterior pair of dorsal spines in the adult animal.

In the first post-larval stage, finally, the telson has assumed the precise appearance characteristic of the adult animal, the middle of the exterior spines having been wholly lost.

Thus, of the spines occurring on the telson in the larva, three pairs only are retained in the adult animal, viz., the lateral spines, which represent the anterior pair of dorsal denticles, the outermost, on either side, of the terminal spines, constituting the posterior pair of dorsal denticles, and the third spine on either side, counted from the outer corner, which are modified to form the peculiar subapical spines of the adult animal. All the other spines wholly disappear in the course of the larval development.

The Uropoda (figs. 37–42).—As stated above, these limbs are entirely wanting in the earliest larval stages (see fig. 36), not appearing till the last Calyptopis stage, when they are (fig. 37) very small and have only an indistinct mark between the basal part and the terminal plates, the latter being furnished with but very few bristles proceeding from their apex; of the plates, the exterior one is the longer, and has the outer corner drawn out to a strong spine. In the following stages (figs. 38–40) the uropoda develop by degrees more fully, the terminal plates increasing in length and becoming furnished with a greater number of bristles, continued along their inner edge, till in the first post-larval stage (fig. 42) they have almost attained the aspect characterising those of the adult animal, though still somewhat shorter in relation to the telson.

The Luminous Apparatus (figs. 9, 25–32).—Of the numerous organs constituting this peculiar apparatus, those occurring in the eye-pedicles of the adult animal are first developed. According to the statements of Metschnikoff, even in the Nauplius stage the peculiar fascicle of glistening fibres, constituting the essential part of these organs, is distinctly seen on either side of the larval eye, or ocellus, no trace of the compound eyes being as yet observed. In all the succeeding stages these organs are readily discerned, imbedded in the base of the developing eyes. The other organs, the true luminous globules, make their appearance at a much later period, and are not all developed at the same time, but appear successively. In the intermediate Furcilia stage (Pl. XXIX. fig. 6) only three such globules are developed, viz., the anterior of the two pairs belonging to the trunk, and the foremost of the odd caudal globules. In the last Furcilia stage the posterior pair belonging to the trunk have likewise appeared, though being still but very faintly defined (see fig. 29), as also another of the caudal globules. The remaining two caudal globules successively appear in the following

Cyrtopia stages, and in the first post-larval stage all of the globules have been fully developed.

The Internal Organs (Pl. XXIX.).—As regards the development of the internal organs, the following observation may be here added:—

The ganglia of the nervous cord are at first imperfectly defined from one another, forming merely a continuous ganglionic mass, exhibiting but slight intumescences at regular intervals. Not till the tail has been fully segmented are the commissures connecting the caudal ganglia distinctly seen, though at first very short.

The digestive system would not seem to commence performing its functions till after the Metanauplius stage, or when the oral organs have become mobile and armed with bristles and spines, a considerable supply of food-yolk having been left within the body of the Nauplius to be at first absorbed. In the earliest Calyptopis stage, however, the intestinal tube is distinctly seen traversing the whole length of the body, and, in living specimens, exhibiting energetic peristaltic movements. Anteriorly, at the junction of the intestine with the stomach, a well-marked rounded cæcum, also present in the adult animal, is seen protruding above. The liver constitutes at first only two or three simple cæciform appendages on either side (see Pl. XXIX. fig. 1). These appendages become in the following stages subdivided into short lobes (see fig. 2), which increase gradually in number, forming at length the compound lobular masses constituting this organ in the adult animal (see following figures). The anal opening is found in the early Calyptopis stages at the base of the spathulate extremity of the tail (telson), in the form of a short longitudinal fissure, bounded by two thickened lips (Pl. XXX. fig. 36).

The heart, even in the earliest Calyptopis stages (and also in the Metanauplius stage), can be distinctly seen beneath the posterior part of the carapace, and resembles, at least as regards form, in every respect that of the adult animal. In living specimens it may at once be detected by reason of its quick and rhythmical pulsations. Furthermore, the chief arteries would seem to be developed even in these early stages, as shown by Professor Claus in his treatise referred to above (page 149).

Development of Thysanopoda tricuspidata, Milne-Edwards (Pl. XXXI. figs. 1–22).

The development of this form differs in certain points distinctly from that of *Nyctiphanes* and *Euphausia*, and the general appearance of the larvæ is so very unlike that of the adult animal, that I certainly should not have been able to refer them to the above named form, if there had not, fortunately, been in the Challenger collection a considerable number of specimens in different stages of development, thus connecting the larval forms with the adult form. The specimen described by Dana as *Cyrtopia rostrata* I regard as belonging to this species. In the following pages I purpose describing some of the most characteristic stages.

Calyptopis Stages (figs. 1, 2, 7, 13–17).—I have only had the opportunity of examining two not very well-preserved specimens in these early larval stages, and have figured both. They were found to represent two successive stages, apparently corresponding to the two last Calyptopis stages, as described above of *Nyctiphanes* and *Euphausia*. The length is respectively $2\frac{1}{2}$ and $3\frac{1}{2}$ mm.

The form of the body in both specimens (figs. 1, 2) is very slender, especially the tail. The carapace is rather large, with evenly arched edges, and forms in front a hood-like expansion, covering the eyes and basal parts of the antennulæ. The tail is distinctly segmented, but in the smaller specimen (fig. 1) the last segment has not yet been defined from the telson, whereas in the other (fig. 2) all the segments are distinct.

The eyes (fig. 7) exhibit a very peculiar form, being oblong-ovate, with the extremity tapering to an obtuse point, on which occur seven distinctly marked lenticular facets of the outer integument. Imbedded within each eye is a dense fascicle of delicate fibres extending well-nigh in the longitudinal axis, and apparently representing the luminous organ.

The antennulæ and antennæ exhibit much the same structure as in the corresponding stages of *Nyctiphanes*, the former organs consisting in both specimens of a triarticulate peduncle and two very small uniarticulate flagella; moreover, in the larger one, the strong spine arising from the basal joint exteriorly has been developed, whereas in the other it is still wanting.

The four pairs of ventral (oral) appendages (figs. 13–16) also present considerable resemblance to those in the Calyptopis stages of *Nyctiphanes* and *Euphausia*, though differing in the following particulars:—

The projection jutting out from the mandible (fig. 13) at the base of the masticatory part is remarkably large and spiniform, tapering to a very acute point. The palp, or terminal part, of the first pair of maxillæ (fig. 14) consists of a single joint bearing three bristles only. That of the second pair of maxillæ (fig. 15) is exceedingly small. On the other hand, the exopodite of the maxillipeds (fig. 16) is relatively larger than in the corresponding stages of *Nyctiphanes* and *Euphausia*, projecting considerably beyond the endopodite, and furnished with five strong ciliate setæ, exclusive of a much shorter seta affixed to its base.

The telson (fig. 17) exhibits the usual spathulate form, being conspicuously expanded towards the apex, which is slightly incurved in the middle, with the lateral corners evenly rounded off. It is armed with the same number of spines as in the larvæ of *Euphausia*, viz., two lateral and thirteen terminal, but the spines are slightly different as regards arrangement and relative size. Thus the lateral spines are affixed somewhat anteriorly to the middle, not posterior to it, as in the larvæ of *Euphausia*. Moreover, the terminal spines are rather unequal in size, the median,

arising from the bottom of the incurvation being very small, whereas the three following on either side increase in size successively. Of the three outer spines, occupying the lateral corners, the innermost is by far the largest, projecting considerably beyond the others.

The uropoda, wanting in the smaller specimen, were distinctly developed in the other (fig. 17), though still rather small.

Furcilia Stages (figs. 3–5, 18, 19).—There are several successive stages in the collection, of which I have figured two, having a length respectively of 4·20 mm. and 5·00 mm. They all are distinguished by an exceedingly slender form and a distinctly marked median bend of the tail.

The carapace has lost the hood-like expansion characteristic of the Calyptopis stages, the frontal margin being deeply emarginate on either side, so as to allow of the eyes projecting freely, and juts out in the middle as a narrow horizontal rostral projection, which in the earlier stage (figs. 3, 4) is truncate at the tip. The inferior margins of the carapace are, moreover, armed posteriorly to the middle with a strong denticle.

The eyes exhibit nearly the same appearance as in the Calyptopis stages, being, however, a trifle more tumid in the middle, and also distinctly pedunculated and mobile. In the latter of the two stages figured here a densely crowded fascicle of visual elements (crystalline cones), enveloped at the base by a dark pigment, has appeared within the extremity of the eye (fig. 8), corresponding, as to number, to the seven lenticular corpuscles mentioned above as occupying the tip of the eye. As will appear from the following development, this is quite a provisional visual apparatus, the true cornea not being developed till a much later period.

In the younger of the two specimens figured here (figs. 3, 4) no trace either of the legs or of the pleopods has yet appeared, the limbs being precisely the same as in the Calyptopis stages. On the other hand, in the somewhat older specimen represented (fig. 5), the budding anterior legs, as also the first trace of the gills, may be distinctly seen behind the maxillipeds. Moreover, on each of the three anterior caudal segments a pair of pleopoda have appeared, but very small, immobile, and without bristles.

The telson (figs. 18, 19) has become rather narrow, scarcely at all expanded at the extremity, which is at first rounded off (fig. 18), without any trace of the original median incurvation. The seven median spines form a continuous row occupying the most prominent part of the extremity, which becomes gradually more prominent (fig. 19), and at length juts forth as a median process on either side of which the large innermost one of the outer spines projects.

Cyrtopia Stage (figs. 6, 9, 20, 21).—In this stage the animal has a length of $6\frac{1}{2}$ to 7 mm., and already exhibits certain characters indicating its parentage. Thus, the carapace presents above, at some distance posterior to the rostral projection, a small knob-like prominence as a trace of the peculiar flattened spine characteristic of the adult animal.

Moreover, the posterior caudal segments are produced, as in the full-grown animal, at the middle of the posterior margin into distinct dorsal projections, of which that on the third segment is the largest. Finally, the first pair of caudal epimera begin to assume their characteristic form, jutting forth anteriorly as small dentiform projections.

The eyes (fig. 9) have acquired a considerable dilatation in the middle anteriorly, and within this dilatation the first faint trace of the true cornea, with its visual elements and ocular pigment, may be seen; the extremity of the eye being still produced into an obtuse point, containing the provisional visual apparatus described above.

The antennæ have lost their mobility, as in the corresponding stage of *Euphausia*, and are so modified as nearly to agree in their structure with those of the adult animal, the two original natatory branches having respectively been transformed into the scale and the flagellum.

Four pairs of legs have developed, and the gills may be distinctly seen along the sides of the trunk beneath the carapace, increasing in size posteriorly, the anterior pairs being still only bifurcate.

On the tail, all the pleopoda have been fully developed and adapted for swimming.

Also the luminous globules are now all well defined.

The telson has acquired its characteristic slender form, and the largest of the terminal spines (see fig. 20) are easily recognised as representing the subapical spines of the adult animal. The median part of the apex is considerably produced, and its tip is not, as in the former stages, truncate, but juts out as an acute angle. The two outermost spines on each side are still unchanged. In one of the following stages (fig. 21) one pair of the latter has withdrawn to the dorsal face of the telson, constituting the posterior pair of dorsal denticles of the adult animal.

Post-Larval Stages (figs. 10–12, 22).—In these stages the animal can easily be recognised as a young *Thysanopoda tricuspidata*, exhibiting, as it does, all the essential characteristics distinctive of that species. It still, however, retains a peculiar remnant of its larval existence. For when viewed from above (fig. 10) the eyes are found to exhibit a most remarkable form, unlike that of the adult animal, being drawn out at the exterior side of the cornea to a mamillar projection, at the tip of which the seven lenticular facets, mentioned above as occurring in the larvæ, form a perfectly circular area, one of the lenses occupying the centre and the other six being placed in a regular circle around it (see also figs. 11, 12). Within this projection the original fascicle of crystalline cones appears with great distinctness, as also the dark pigment deposited at their base. On the other hand, the true cornea, though considerably expanded, is still very imperfectly developed, its areolation being indistinctly marked, and the pigment having a rather diffuse character. In the following stages this part, however, becomes gradually more fully developed, while the mamillar projection is reduced in size and finally disappears altogether.

The telson assumes, even in the first of the post-larval stages, the form characteristic of the adult animal, the apex (fig. 22) being produced into an acuminate point, armed on either side with three small denticles—the original terminal spines. Moreover, the outer spine, occurring in the last Cyrtopia stage next to the subapical spines, has entirely disappeared.

Development of Nematoscelis rostrata, G. O. Sars (Pl. XXXI. figs. 23–29).

The earlier larval stages of this form would not seem to exhibit any marked peculiarities, and hence I shall only describe three of the later stages, in which the characters of the genus are first discerned. Two of these are Furcilia stages, the third a Cyrtopia stage.

Furcilia Stages (figs. 23, 24, 26–28).—The form of the body in these stages, which measure respectively $3\frac{1}{2}$ mm. and 4 mm. in length, is far from being so slender as in the corresponding stages of *Thysanopoda tricuspidata*, resembling in this respect more closely the Furcilia stages of *Euphausia*.

The carapace has on either side a very strong lateral denticle, projecting from the inferior margin posteriorly to the middle, and is also distinguished by a conspicuous rounded crest, rising from about the middle of the dorsal face. The rostral projection is very large, horizontal and sharply pointed, though broad and flattened at the base, more especially in the earlier stage.

Of legs, two pairs have made their appearance, being, however, in the earlier of the two stages (figs. 23, 26) still very imperfect as to structure, non-articulate, and without bristles. But even in this rudimentary state the peculiar modification of the first pair, so characteristic of the genus, is distinctly recalled, the corresponding buds (fig. 26) being remarkably massive, and exhibiting a most conspicuous S-shaped flexure. In the later stage (fig. 24) both of the two anterior pairs of legs have become articulated, and the first pair now very clearly present the peculiar structure characteristic of the genus *Nematoscelis*, though they are as yet far from having attained their full length. In this stage also some of the gills are seen budding forth behind these legs.

Of the pleopoda, four pairs only have been formed in the earlier of the two stages (fig. 23), and of these the first pair only are differentiated into a basal part and terminal plates, whereas the other three still represent merely simple bud-like processes. In the later stage (fig. 24), on the other hand, all the pleopoda have appeared, and only the last pair retain their original bud-like character, whereas the other pairs are fully developed and adapted for swimming.

The telson in the earlier stage (fig. 27) is still rather broad, and slightly expanded at the apex, with a pair of lateral spines about the middle of its length. The number of terminal spines is that usually met with, viz., thirteen, seven of which form a continuous

series along the abruptly truncate middle part, whereas the six others are arranged, three on either side, along the obliquely rounded lateral corners. Of the latter, the innermost is by far the largest. In the later stage, the telson has become considerably narrower, and the middle part of the apex (fig. 28) has begun to jut forth as a still rather broad projection, truncate at the tip.

Cyrtopia Stage (figs. 25, 29).—The transformation of the antennæ clearly distinguishes this stage from the two former as a true *Cyrtopia*. The animal has now attained a length of 4½ mm., and may easily be recognised as a young *Nematoscelis rostrata*. The first pair of legs are considerably elongated and slender, having nearly attained the structure characteristic of the adult animal, and the gills are also more fully developed. All the pleopoda have assumed their definitive form, and the luminous apparatus would also seem to be distinctly developed. The telson closely resembles in form that of the adult animal, but still retains some of the larval spines. The middle projection of its extremity (fig. 29) is considerably produced, but narrowly truncate at the tip; and of the seven original spines, three only remain. Of the three outer spines, the innermost on either side is much larger than the others, and has assumed the character of the subapical spines. In a succeeding stage, the outermost on either side is withdrawn to the dorsal face of the telson, thus constituting the posterior pair of the dorsal denticles of the adult animal, whereas the intermediate spine has altogether disappeared.

Larval Stage of Euphausia sp. (?).

First Furcilia Stage (Pl. XXXI. figs. 30, 31).—I give a figure of this larva, not only because it exhibits an unusual size and a rather peculiar aspect, but also because another stage of precisely the same form has been described at a much earlier date, without, however, having been at that time recognised as a larva of *Euphausia*.

In the second part of his researches on the structure and development of the Arthropoda,[1] Professor Dohrn has given figures and descriptions of several very remarkable larval forms,[2] of which that figured in plate 30, fig. 54 undoubtedly represents a Calyptopis stage of precisely the same form as that treated of here. This larva was met with in the Indian Ocean, and regarded by Professor Dohrn—though with some reservation—as a Peneuszoëa. That this assumption is erroneous, and that the larva in question should be comprised under the Euphausiidæ, I feel no doubt whatever in asserting; and, moreover, I think there are reasons for assuming both these larvæ to belong to a large-sized species of the genus *Euphausia*, perhaps that briefly mentioned by the late Dr. v.

[1] *Zeitschr. f. wiss. Zool.*, Bd. xxi., p. 356, 1871.

[2] I take the present opportunity of stating my conviction that the forms described by the said author as *Cerataspis monstruosa*, Gray, and *Cerataspis longiremis*, n. sp., and considered as adult animals belonging to the Schizopod tribe, are both of them larvæ in the last stage (Mysis stage) of some large forms of Macrura of the Homaroid group.

Willemoes-Suhm under the name of *Euphausia simplex*, but unfortunately wanting in the collection.

What distinguishes these larvæ at the first glance is the very peculiar armature of the free edges of the carapace, which are coarsely and elegantly denticulate in a regular pectiniform manner, the denticulation being quite continuous all round in the Calyptopis stage described by Dohrn, whereas in the Furcilia stage represented here it is interrupted by the lateral emarginations of the frontal margin, from which the eyes project.

The solitary specimen in the collection (fig. 30) has a length of nearly 5 mm., and evidently corresponds, as regards the development of the limbs, to the first Furcilia stage of *Euphausia pellucida* (Pl. XXIX. figs. 4, 5), from which, however, it differs, not only in its much larger size and the above-mentioned peculiar armature of the carapace, but in some other points to be set forth in the sequel.

The carapace is comparatively very large and tumid, and has the inferior margins strongly arched in the posterior part and somewhat incurved anteriorly to the middle, as also terminating anteriorly in an acutely produced angle. Posteriorly, it juts forth in the middle as a rather strong, spine-like projection, and is, moreover, provided in the middle of the dorsal face with a distinctly marked rounded crest. The frontal plate is very large and broadly rounded at the extremity, and coarsely denticulate along the terminal edge, the denticles being somewhat larger than those occurring along the inferior margins of the carapace.

The tail is comparatively slender, and has the edges of the rounded epimera finely serrate. The third segment juts out posteriorly as a small but well-defined dorsal projection. The last segment is but little longer than the preceding, and quite smooth.

The eyes are rather large and projecting, of a slender clavate form, with the corneæ comparatively small.

Of limbs, the antennulæ, antennæ, mandibles, two pairs of maxillæ, and the maxillipeds are distinctly developed, exhibiting, it would seem, a structure closely resembling that in the corresponding stage of *Euphausia pellucida*. In addition, as in that stage, the first trace of the anterior pair of legs and of the first pair of pleopoda has appeared, both having as yet merely the form of small bud-like processes.

The telson (fig. 31) is very large, almost equalling in length the three preceding segments taken together, and gradually expanding towards the apex, which is broadly truncate and slightly emarginate in the middle. The number of spines is as usual fifteen; meanwhile both the lateral and three outer on each side of the terminal ones are remarkably large and spinulose at the edges, whereas the seven median are very small, especially the middle one, which is, moreover, quite smooth. The lateral spines are placed at the last third of the length of the telson; and of the three outer spines of the terminal edge, the middle one is much the largest, projecting far beyond the rest.

The uropoda (fig. 31) are still rather small, but have their basal part and terminal plates well defined, the latter exhibiting a few slender marginal bristles. The outer plates are highly distinguished by the remarkable length of the spine jutting out from the outer corner; moreover, this spine is finely denticulate along the inner edge.

Habitat.—The larva described above was taken December 24, 1873, in the Southern Ocean, off Prince Edward Island.

Family 4. Mysidæ.

This family, the lowest in rank among the Schizopoda, comprises both littoral and pelagic forms, as also true deep-sea animals. In none of them is the slightest trace of true gills to be observed, and they are thereby very sharply defined from the three preceding families of Schizopoda, in which the gills are invariably well developed. In some forms, however, a peculiar folding of the integument, covered by the free parts of the carapace, can be discerned, and this structure may possibly stand in some relation to the respiratory function, though scarcely corresponding morphologically to the true gills in other Podophthalmia. I first called attention to this peculiar structure as early as the year 1867, when describing the fresh-water variety of *Mysis oculata*, Fabr. (*Mysis relicta*, Lovén),[1] and shall in the present Report describe a similar structure in the large deep-sea Mysidan, *Boreomysis scyphops*, G. O. Sars. Another appendage, peculiar to the males only, and issuing from the base of the inner branch of the pleopoda, may perhaps be also regarded as subservient to respiration. More especially in the males of the genus *Siriella*, Dana (*Cynthia*, Thompson), do these appendages present an appearance that strongly recalls that of true gills.

As a character common alike to all Mysidans, and sharply distinguishing them from other Schizopoda, may be mentioned the rudimentary state of the caudal limbs in the females, forming, as they do, very small setiferous lamellæ that have no relation whatever to locomotion, and thus have little or no claim to the term "pleopoda." This, in some genera, as *Mysis*, *Heteromysis*, *Mysidella*, also applies to the males. But in most of the genera the caudal limbs in the males are modified so as to assume the character of true natatory organs, being constructed in a manner similar to the pleopoda in the Lophogastridæ and Eucopiidæ.

The Mysidæ comprise numerous genera, most of which are met with in the Northern Ocean, and some of the species, as *Mysis oculata*, Fabr., are at times found crowded together in enormous shoals, thus serving as food for whales and other large vertebrates.

The Challenger collection comprises fifteen species of Mysidæ, belonging to eight genera, one of which is new.

[1] Histoire naturelle des Crustacés d'eau douce de Norvège, pt. i.

The following is a synopsis of the genera represented in the collection :—

- Number of incubatory lamellæ, composing marsupial pouch in female,
  - seven pairs. Male
    - greatly differing from female, having mandibular palp and gnathopoda remarkably modified, . *Petalophthalmus*, Suhm.
    - differing from female in the usual manner, chiefly as regards the structure of the caudal limbs, . *Boreomysis*, G. O. Sars.
  - two pairs only, with a rudiment of a third pair. Eyes
    - imperfectly developed, lamelliform. Legs
      - rather strong, with a distinct terminal claw, ... *Amblyops*, G. O. Sars.
      - remarkably slender, filiform, without any terminal claw, . . *Pseudomma*, G. O. Sars.
    - of the usual structure. Caudal limbs in male
      - natatory. Propodal joint of legs
        - non-subdivided or only bi-articulate, terminal claw very strong, . *Siriella*, Dana.
        - subdivided into three or more articulations. Antennal scale
          - remarkably small, . *Anchialus*, Kröyer.
          - lanceolate, setose on both edges, . *Mysidopsis*, G. O. Sars.
          - obliquely truncate at apex, outer edge smooth, . *Euchætomera*, G .O. Sars.
      - rudimentary as in female, . . *Heteromysis*, Smith.

Genus 1. *Petalophthalmus*, Willemoes-Suhm, 1879.

Petalophthalmus, Suhm, Trans. Linn. Soc. Lond., ser. 2, vol. i.

Generic Characters.—Female exhibiting the usual Mysidan appearance; male very dissimilar, with mandibular palps prodigiously developed, and some of the limbs of the trunk also remarkably modified. Eyes in both sexes leaf-like, without any visual elements or pigment. Antennular peduncle greatly elongate in male, and without the usual hirsute lobe. Antennal scale lanceolate and setose on both edges. Gnathopoda in male very strong, subcheliform. Marsupial pouch in female composed of seven pairs of incubatory lamellæ. Caudal limbs of male scarcely natatory, inner branch simple, naked, styliform, outer non-articulate, slightly dilated in the middle, and having an oblique series of delicate bristles. Telson with apex entire, not incised in the middle. Outer plates of uropoda distinctly jointed at apex.

Remarks.—The remarkable form on which the above characterised genus has been based, exhibits, in the female, some affinity to the genus *Boreomysis*, G. O. Sars, the marsupial pouch being, as in that genus, composed of seven pairs of incubatory lamellæ, and the structure of the legs somewhat similar. Nevertheless, the very striking appear-

ance of the male at once distinguishes this genus from all other known Mysidans, the sexual characters being quite anomalous and differing from what is usually met with in this family. Moreover, the structure of the antennal scale and of the telson, as also that of the outer plates of the uropoda, would seem to afford well-marked characters, distinguishing this genus from the genus *Boreomysis*. As regards the imperfect development of the eyes, which has suggested the generic name, that character is also found in one of the species belonging to the above mentioned genus, viz., in *Boreomysis scyphops*, G. O. Sars, to be described in the sequel.

42. *Petalophthalmus armiger*, Willemoes-Suhm (Pl. XXXII. figs. 1–9).

Petalophthalmus armiger, Suhm, Trans. Linn. Soc. Lond., ser. 2, vol. i. p. 40, pl. viii.

Specific Characters.—Male: Body rather slender, well-nigh cylindrical in form. Carapace remarkably small and not nearly covering whole of trunk, two segments of which are entirely exposed; cervical sulcus well marked; frontal margin forming, in the middle, only a very small projection; antero-lateral corners narrowly rounded. Eyes forming two very thin oval lamellæ, supported on short pedicles. Antennular peduncle exceedingly slender, with basal joint longer than the two others taken together, flagella shorter than peduncle, subequal. Antennal scale narrow, lanceolate, projecting but slightly beyond basal joint of antennulæ; flagellum imperfectly developed, shorter than scale, biarticulate. Mandibular palp projecting beyond antennular peduncle, last joint reflexed and armed with seven strong spines. Maxillipeds short and thick, without exopodite, meral joint expanded interiorly to a linguiform lobe, terminal joint unguiform. Gnathopoda of a structure similar to maxillipeds, but much larger. The three anterior pairs of legs with last joint densely hirsute; remaining pairs very slender, with terminal part not subdivided, and having a distinct but feeble claw. Telson oblongo-quadrangular, apex broadly truncate, jutting out in the middle as a short dentiform projection, and having on either side five strong spines; lateral edges finely denticulate in the outer half. Terminal joint of outer plates of uropoda very sharply defined, linguiform. Length, 40 mm.

Remarks.—Of this interesting form I have only had opportunity of examining a single male specimen, apparently that described by the late Dr. v. Willemoes-Suhm. That author has also described the female; but the specimen from which his description was drawn up has unfortunately been lost. To judge from the figures given, it would seem to have presented a far less deviating appearance, resembling rather the species of the genus *Boreomysis*.

Description of the Male.—The specimen examined by me, which apparently is full-grown, measures 40 mm. in length.

The form of the body (see Pl. XXXII. fig. 1) is very slender and well-nigh cylindrical, without exhibiting any sharp demarcation between the anterior and posterior divisions.

The carapace is remarkably small, so as to cover only the anterior part of the trunk, whereas the two posterior segments of the latter are exposed behind it around the whole of their circumference. Moreover, the lateral wings of the carapace, in the specimen examined, were greatly inflected or doubled over, and thus the lateral parts of the two preceding segments also appear uncovered inferiorly. The carapace exhibits a well-marked cervical sulcus, behind which the linguiform dorsal area is distinctly seen. The frontal margin is truncate, with but a very small dentiform projection in the middle (see fig. 2) as a rudiment of the rostrum. The antero-lateral corners of the carapace are narrowly rounded.

The caudal segments are simple cylindrical, without any trace of epimera, the anterior ones differing but slightly in size and appearance from the two posterior segments of the trunk. The last segment, on the other hand, is rather elongate, about as long as the two preceding ones taken together.

The eyes (fig. 3) are quite rudimentary, without any trace either of pigment or visual elements, constituting merely two thin and pellucid lamellæ, of an oblong form, and mounted on very short and narrow pedicles. They would seem to a certain extent movable, and, in the specimen examined, were directed upwards, with their inner faces parallel to each other and to the axis of the body.

The antennular peduncle (see figs. 1, 2) is very slender and elongate, nearly equalling the carapace in length, and has the basal joint longer than both the others taken together. The last joint is rather small, and does not exhibit any trace of the hirsute lobe, usually met with in male Mysidans. The flagella are shorter than the peduncle, well-nigh uniform in structure and length, and composed of several short articulations.

The antennal scale (figs. 1, 2, 4) projects but slightly beyond the basal joint of the antennulæ, and exhibits a very narrow lanceolate form, the edges being densely setiferous all round. The flagellum is most imperfectly developed, and totally wants the terminal part, constituting, as it does, merely a short biarticulate stem, corresponding to the basal portion or peduncle in other Mysidans. This stem scarcely reaches to the tip of the scale, and is provided with a dense tuft of apical bristles.

The mandibular palps being, according to the statement of the late Dr. v. Willemoes-Suhm, of quite normal appearance in the female, exhibit in the male (see fig. 1) a truly remarkable development, projecting, as they do, in the form of a pair of very powerful limbs far beyond the antennular peduncles. Their middle joint is by far the largest and strongly muscular, and also furnished along the lower edge with numerous tufts of small bristles. The last joint is sharply reflexed, forming along with the preceding joint a geniculate bend, and is armed with seven strong unguiform spines, three of which spring from the apex, and two from each of the edges. These limbs serve in all probability as powerful prehensile organs, by the aid of which the male clasps the female during

copulation; but in no other Crustaceans has a similar modification of these limbs ever been observed.

As regards the structure of the mandibles themselves, and the maxillæ, we cannot of course give any reliable information, since these organs do not admit of being examined in the solitary specimen before us. In the female, their structure would seem, to judge from the description given by the late Dr. v. Willemoes-Suhm, to be on the whole quite normal.

The maxillipeds (fig. 6) are short and thickset in structure, without any trace of the usual exopodite, and want also, it would seem, the epipodite. They consist, however, of the usual number of joints, which together form a strongly curved stem. The meral joint is expanded interiorly to a rather large linguiform lobe, against which the outer part of the maxilliped admits of being impinged. The terminal joint has the form of a strong claw.

The gnathopoda (or first pair of legs) exhibit a structure much resembling that of the maxillipeds, though considerably larger and having the meral lobe comparatively more powerfully developed. No trace of an exopod can be detected, and the aspect of these limbs is, on the whole, very dissimilar from that of other Mysidans. In the female, however, to judge from the figure given by the late Dr. v. Willemoes-Suhm, they would not seem to exhibit any marked difference from that usually met with in Mysidans, and hence the peculiar modification both of these limbs and the maxillipeds in the male must certainly stand in some relation to the act of copulation.

Of the true legs, the two anterior pairs had been broken off in the specimen examined, their basal parts only, with the corresponding exopods, remaining intact. The third pair (see fig. 1) exhibit a form somewhat resembling that of the gnathopoda in other Mysidans, the terminal joint being not unguiform but obtuse and densely hirsute; and the two anterior pairs may, very probably, also have exhibited a similar appearance. The three remaining pairs of legs are exceedingly slender, and have the terminal part, or propodal joint, not subdivided, as in most other Mysidans, and the last joint modified to a distinct, though very feeble claw.

The caudal limbs (fig. 7) are not, as usual in the males of most other Mysidans, modified to natatory organs, or pleopoda, though somewhat dissimilar in structure from those in the female. They consist of a rather feeble basal part and two very unequal terminal branches. The outer of these forms merely a slender cylindrical simple appendage, without any armature whatever, whereas the inner branch is rather large and somewhat expanded in the middle, having there an obliquely transverse series of very delicate bristles, the terminal part tapering somewhat and furnished with two bunches of short bristles. Any distinct articulation cannot be detected in either of the branches.

The telson (fig. 8) is a trifle shorter than the last segment, and exhibits the form of an oblongo-quadrangular plate, being everywhere about of the same breadth and

broadly truncate at the apex. The lateral edges are in the outer half finely denticulate, and the apical edge juts forth in the middle as a short dentiform projection, on either side of which are affixed five strong spines (see fig. 9).

The uropoda (see fig. 8) have the inner plates of about the same length as the telson and narrowly lanceolate in form, whereas the outer plates are considerably larger, and clearly distinguished by the outer linguiform part being marked off from the plate by a very distinct articulation, a feature not observed in any other known form of Mysidans. The outer edge of the plate is quite smooth, and terminates as a distinctly projecting corner bearing a short spine, whereas the terminal articulation and also the whole inner edge of the plate is fringed with a dense row of ciliate setæ.

Habitat.—The above described specimen was taken in the Tropical Atlantic, at a very considerable depth. Locality: Station 104, August 23, 1873; lat. 2° 25′ N., long. 20° 1′ W.; depth, 2500 fathoms; Globigerina ooze; bottom temperature, 36°·6.

Genus 2. *Boreomysis*, G. O. Sars, 1869.

Boreomysis, G. O. Sars, Undersögelser over Christianiafjordens Dybvandsfauna.

Generic Characters.—Carapace rather large, covering most of trunk, antero-lateral corners produced, lobiform. Tail slender, cylindrical, with last segment longest. Antennular peduncle comparatively robust, with male appendage very short, tuberculiform; outer flagellum more or less distinctly expanded at base. Antennal scale elongate, sublinear; outer edge smooth, terminating in a dentiform projection. Last joint of mandibular palp narrowly oblong. Second pair of maxillæ with inner expansion of basal part very broad, terminal joint oval, with some of the bristles recurved. Gnathopoda elongate, with terminal joint very mobile and densely hirsute. Legs rather slender, subequal, with propodal joint subdivided into two or three articulations, terminal joint unguiform. Marsupial pouch in female composed of seven pairs of incubatory lamellæ. Caudal limbs in male all natatory, with very elongate branches. Telson large, deeply incised at apex. Outer plate of uropoda with a ledge-like prominence in front of the middle exteriorly, bearing two small denticles. Auditory apparatus at base of inner plate rudimentary.

Remarks.—This genus is distinguished from most other Mysidans by having the marsupial pouch of the female composed of seven pairs of incubatory lamellæ. In this character it agrees only with the preceding genus, from which, however, it may be easily recognised by a deviating structure of the antennular peduncle, the antennal scale, and the caudal fan, besides the male sexual characters, which in the present genus are quite normal, whereas in the former they are very peculiar and anomalous.

The typical species is *Boreomysis arctica* (Kröyer), first met with in the Arctic Sea,

off Greenland, and also occurring along the coasts of Norway, where two other species, *Boreomysis tridens*, G. O. Sars, and *Boreomysis megalops*, G. O. Sars, have been also observed. Moreover, on the Norwegian North Atlantic Expedition two large species were taken, *Boreomysis nobilis*, G. O. Sars, and *Boreomysis scyphops*, G. O. Sars, the latter of which is also represented in the Challenger collection. Finally, there are two additional species from the Challenger Expedition, to be described further on. The total number of species thus amounts to seven. All are true deep-sea forms, the animals descending to very considerable depths, and having never been met with in shallow water.

The following is a synopsis of the three Challenger species :—

- Eyes
  - imperfectly developed, calyciform, without pigment or visual elements, . *B. scyphops*, G. O. Sars.
  - of the usual structure,
    - short and thick, almost circular, with cornea greatly expanded. Frontal margin obtusely rounded, ... *B. obtusata*, G. O. Sars.
    - narrow, almost fusiform, with cornea very small. Frontal margin with a small pointed projection in the middle, . *B. microps*, G. O. Sars.

43. *Boreomysis scyphops*, G. O. Sars (Pl. XXXII. figs. 10–20).

Petalophthalmus inermis, Suhm MS.

Boreomysis scyphops, G. O. Sars, Crustacea et Pycnogonida nova in itinere 2do et 3tio Expeditionis Norvegicæ anno 1877–78 collecta, No. 3.

Boreomysis scyphops, G. O. Sars, The Norwegian North Atlantic Expedition, 1876–1878, Crustacea, i. p. 56, pl. vi.

Specific Characters.—Frontal part of carapace without any distinct rostrum, projecting but slightly in the middle; antero-lateral lobes obtuse at apex. Eyes without pigment or visual elements, constituting two pedunculated concave, or well-nigh calyciform lamellæ, placed vertically. Antennular peduncle comparatively smaller than in the other species, and of more normal form. Antennal scale rather elongate, about twice as long as antennular peduncle, slightly tapering, denticle of outer corner somewhat projecting. Propodal joint of legs subdivided into two articulations only; exopods remarkably elongate, with terminal part composed of numerous articulations. Telson almost equalling in length the two preceding segments taken together, outer part slightly tapering, and fringed with numerous small denticles, apical incision narrow, occupying nearly one-fourth of the length of telson. Inner plate of uropoda reaching tip of telson, outer plate much larger. Colour a uniform pale red. Length reaching 85 mm.

Remarks.—This gigantic Mysidan was first met with on the Challenger Expedition in the subantarctic region of the Southern Ocean, and has been briefly recorded by the late Dr. v. Willemoes-Suhm under the provisional name of *Petalophthalmus inermis*. Subsequently the same form was obtained on the Norwegian North Atlantic Expedition

in the Arctic Sea, and has been more fully described by the author under the name of *Boreomysis scyphops*. Although the former appellation has without a doubt claim to priority, I have seen fit to retain that proposed by myself, for the following reasons:— First, it is obvious that the said form cannot properly be comprised within the same genus as the preceding anomalous Mysidan, the only characters peculiar to both being merely the rudimentary condition of the eyes, whereas in all other respects it agrees much more closely with the species of the genus *Boreomysis*, to which of course it should rightly be referred. Secondly, this admitted, the specific name *inermis* would be quite inappropriate, referring, as it does, to the absence in the male of similar prehensile organs as in *Petalophthalmus armiger*, such a peculiar prehensile apparatus being never found in any species of the genus *Boreomysis*. Thirdly, no description of this form has been given by the late Dr. v. Willemoes-Suhm, by whom the animal is only briefly recorded as a new species.

Although a full account of the present interesting Mysidan, with figures representing both sexes, has been given in the Report on the Crustacea collected on the Norwegian North Atlantic Expedition just published, I have deemed it advisable to append the following somewhat modified description of the Challenger form.

Description.—Most of the specimens in the collection are females, and of the two male specimens found, none is yet fully developed. The largest female specimen measures about 85 mm. in length from the tip of the antennal scale to that of the uropod, or still somewhat more than the arctic specimens collected on the Norwegian Expedition.

The form of the body (see Pl. XXXII. fig. 10) is somewhat robust, with the anterior and posterior divisions pretty well defined.

The carapace is rather large, covering the whole of the trunk, except a small part of the last segment, which appears exposed above. Moreover, the rounded lateral parts or wings of the carapace slightly overlap the first caudal segment. The cervical sulcus is very distinctly defined, marking off the cephalic section or frontal part of the carapace. The latter portion is evenly arched above, without any keel, and juts forth anteriorly in the middle as a slightly projecting angle. At the sides, the frontal margin forms, as in the other species, a deep emargination almost wholly exposing the basal part of the antennæ (see figs. 10, 11). Beneath this emargination each of the antero-lateral corners projects as a linguiform lobe, obtuse at the tip. The dorsal area is seen extending posteriorly behind the cervical sulcus as a narrow linguiform space, reaching to about the posterior third of the length of the carapace.

On removing the free parts of the carapace (see fig. 11) all the segments of the trunk are visible, as in the Lophogastridæ and Eucopiidæ, distinctly defined in their whole circumference, though densely crowded dorsally, in such a manner that only the last segment has the dorsal face of any considerable extent, whereas the others are extremely narrow, almost riband-shaped in that part. Laterally, each of the six anterior segments

produce a peculiar folding of their integument, increasing in breadth inferiorly and exhibiting here as it were an imbricate appearance. These peculiar cuticular folds, first noticed by the author when describing the fresh-water variety of *Mysis oculata*, Fabr. (*Mysis relicta*, Lovén), occur more or less distinctly developed in all Mysidans, and may to some extent compensate for the absence of true gills, these parts being constantly bathed by the current of water flowing beneath the free parts of the carapace, and chiefly produced by the oscillatory movements of the epipodite of the maxilliped that projects within the branchial cavity anteriorly.

The caudal segments are perfectly cylindrical, without the slightest trace of epimera, and somewhat less in breadth than the anterior part of the carapace. The last segment is much the longest, about twice as long as the preceding.

The eyes (fig. 13) exhibit nearly the same imperfect structure as in the genus *Petalophthalmus*, lacking, as they do, every trace of pigment and visual elements, and constituting merely simple lamellar or petaloid expansions, mounted in a vertical position on short pedicles. As to form, they differ somewhat from those in *Petalophthalmus armiger*, being distinctly hollowed on the outer face, or well-nigh calyciform, their aspect being almost as if the true eye-globe or cornea were extirpated, and only the skin of the pedicle left. Anteriorly they form a slight angular projection, being for the rest of a somewhat irregular oval form.

The antennular peduncle (see figs. 10–12) is comparatively smaller than in the other species of the genus, and has also a more regular cylindrical form, the second joint being simple and not discoidal or cup-shaped. The outer flagellum forms only a slightly defined expansion at the base.

The antennal scale (see fig. 12) is rather large, almost twice as long as the antennular peduncle, tapering toward the apex, which is obliquely rounded, with the outer corner somewhat projecting and dentiform.

The mandibles (fig. 14) exhibit the structure characteristic of the genus, the palp being rather elongate, with its terminal joint narrowly oblong.

The first pair of maxillæ (fig. 15) are also quite normal in structure and agree as regards all essential features with those organs in the other species of the genus.

The second pair of maxillæ (fig. 16) have the basal part rather large, forming inwards a slightly arched and sharp border, densely beset with delicate curving bristles. There are, as usual, three masticatory lobes densely crowded together at the inner corner of the basal part. The exognath is but of moderate size and elliptical in form, fringed with delicate plumose setæ along the outer edge. The terminal joint of the palp is oblong, and has the bristles of the outer edge recurved, as in the other species of the genus.

The maxillipeds (fig. 17) are not particularly powerful in development, and have the basal part of about the same length as the terminal or palp, projecting inward as a narrow, linguiform masticatory lobe. Of the joints of the palp the antepenultimate

(carpal) is the longest; the terminal joint is conically pointed and provided at the tip with a strong unguiform spine. The exopodite (see fig. 11) is very fully developed, in the same manner as the true exopods. The epipodite is narrowly lanceolate or almost falciform, and about as long as the basal part.

The first pair of legs (fig. 18) differ, as in other Mysidans, conspicuously from the rest, being modified to serve as true gnathopoda. They are rather elongate, with the carpal joint longest. The propodal joint, which, as a rule, forms along with the former a sharp geniculate bend, is somewhat dilated towards the end, exhibiting there, at the inner edge, a slight incurvation to receive the terminal joint when bent in. The latter is very small and densely hirsute, as also exceedingly mobile. The exopod is remarkably elongate, its terminal part consisting of a great number of short setiferous articulations.

The true legs are all of them uniform in appearance, somewhat slender and densely setiferous, more especially along their inner edge. The propodal joint (see fig. 19) is in all subdivided only into two articulations of unequal size, the proximal more than twice the length of the distal, and furnished with dense fascicles of setæ. The terminal joint has the form of a slender claw. The exopod is very greatly developed, and of precisely the same structure as in the gnathopoda.

The marsupial pouch of the female is composed, as in the other species of this genus, of seven pairs of incubatory lamellæ, originating from the bases of the gnathopoda (see fig. 18) and all of the true legs; they increase successively in size from before backwards (see fig. 11).

The telson (see fig. 20) is comparatively large, attaining almost the length of the two preceding segments taken together, and has the form of an oblong lamella, slightly channelled above and somewhat tapering in its outer part, which is edged with numerous small denticles of unequal size. The apex is deeply incised, the incision being very narrow, and occupying almost one-fourth of the length of the telson. The terminal lobes, limiting the incision, are obtusely pointed, and bear on the tip several denticles of unequal size, as also along their inner edge a dense fringe of fine spinules.

The uropoda (*ibid.*) have the terminal plates of very unequal size, the inner plate scarcely projecting beyond the telson, whereas their exterior plate is much larger and somewhat oblong in form, having, as in the other species, a small ledge-like projection at the outer edge, near the base. The auditory apparatus within the base of the inner plate would seem to be quite rudimentary, indeed well-nigh obsolete.

The nervous cord (see fig. 12) exhibits a structure somewhat differing from that described by the author in *Mysis relicta*. The ganglia of the anterior division of the body, exclusive of the brain or supra-œsophageal ganglion, are not, as in that Mysidan, connate, but distinctly defined, though lying, as it were, imbedded in a common sheet of connective tissue. On closer examination, eleven separate ganglia may be readily counted, connected together by very short double commissures; but these commissures

would not seem to be fibrous but rather of a similar cellular structure to that of the ganglia themselves. On the other hand, the ganglia of the tail are connected by very long and narrow, distinctly fibrous commissures, placed close together.

The colour of the animal, in a fresh state, as observed on the Norwegian North Atlantic Expedition, was a uniform pale red.

Habitat.—Several specimens of this magnificent Mysidan were collected on the Challenger Expedition in the Southern Ocean from very great depths. The following is a list of the Stations :—

Station 147, December 30, 1873 ; lat. 46° 16′ S., long. 48° 27′ E. (off Crozet Islands) ; depth, 1600 fathoms ; Diatom ooze ; bottom temperature, 34°·2.

Station 157, March 3, 1874 ; lat. 53° 55′ S., long. 108° 35′ E.; depth, 1950 fathoms ; Diatom ooze ; bottom temperature, 32°·1.

Station 158, March 7, 1874 ; lat. 50° 1′ S., long. 123° 4′ E.; depth, 1800 fathoms ; Globigerina ooze ; bottom temperature, 33°·5.

Distribution.—The geographical distribution of this form is very remarkable, ranging, as it does, within the limits of well nigh the same region in both hemispheres, and not occurring in the intermediate tracts of the ocean. As it cannot be reasonably assumed that the species has originated independently in both hemispheres, the physical condition of the sea-bottom must at some time or other have been more uniform than at present, to have admitted of the species spreading over a much more extensive area, whereas at a later period essential changes in the climatological conditions must be assumed to have caused this form to withdraw successively from the equatorial region towards the two poles, thus dividing the species into two widely separated stocks, inhabiting corresponding regions in both hemispheres. Another fact, too, viz., the remarkable occurrence, as stated above, of the northern form, *Lophogaster typicus*, M. Sars, in the Southern Ocean, without its being ever met with in the intermediate tracts, may also warrant the assumption of essential changes in the physical conditions of the sea-bed having taken place at some former period, thus causing the occurrence of certain species to appear discontinuous.

44. *Boreomysis obtusata*, G. O. Sars (Pl. XXXIII. figs. 1–6).

Boreomysis obtusata, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 42.

Specific Characters.—Male :—Anterior part of carapace not keeled above nor forming any distinct rostral projection, the frontal margin being broadly rounded, with but a very slight angle in the middle ; antero-lateral lobes sharply pointed. Eyes well developed, rather short and broad, almost circular, cornea greatly expanded, with reddish pigment. Antennular peduncle rather stout, with second joint very short, discoidal. Antennal scale oblong, tapering, apex narrowly truncate, denticle of outer corner but slightly projecting. Propodal joint of legs subdivided into three distinctly defined articulations.

Telson somewhat narrowed in outer part, apical incision occupying scarcely one-fifth of the length of the telson, rounded at bottom; terminal lobes narrow, obtuse at tip. Length, 30 mm.

Remarks.—This species is nearly allied to the two northern species *Boreomysis nobilis*, G. O. Sars, and *Boreomysis tricornis*, G. O. Sars, but may at once be distinguished by the obtusely rounded frontal margin, that exhibits neither a distinct rostral projection, nor any trace of lateral processes.

Description.—Only two specimens—both adult males—are comprised in the collection, one of which is somewhat defective. The larger of the specimens measures 30 mm. in length.

The form of the body (see Pl. XXXIII. fig. 1) is somewhat short, nearly as in the Norwegian species *Boreomysis tricornis*, the tail only slightly exceeding in length the anterior division of the body.

The carapace is rather large, covering, as in the preceding species, the whole of the trunk, saving a very small part of the last segment that appears exposed above within the bottom of the posterior emargination. The anterior part, in front of the cervical sulcus, is evenly arched above, without any dorsal keel, and the frontal margin forms an almost even curve, without any distinct rostral projection, presenting but a very slight and inconspicuous angular prominence in the middle (see figs. 2, 3). The antero-lateral lobes are rather produced and sharply pointed at the tip.

The caudal segments are cylindrical, and, as usual in the males, rather thick and muscular, the last somewhat elongate, about as long as the two preceding taken together.

The eyes (see figs. 1, 2) are perfectly normal in structure, and rather short and thick, almost circular, and somewhat flattened, with the cornea greatly expanded and provided with a dark reddish pigment and well-developed visual elements.

The antennular peduncle (*ibid.*) is rather stout and somewhat similar to that in the typical species, the second joint being extremely short, almost discoidal. At the extremity of the peduncle, beneath the insertion of the flagella, is seen the male appendage, which is very short, tuberculiform, but furnished with a dense tuft of delicate sensory hairs.

The antennal scale (fig. 4) projects considerably beyond the antennular peduncle, without, however, attaining double its length. It is oblong-linear in form, tapering toward the apex, which is narrowly truncate, with the denticle of the outer corner but slightly projecting.

The legs are rather slender, and have all the propodal joints subdivided into three distinctly defined articulations (see fig. 5), the first of which is much the largest, and provided at the inner edge with several bunches of slender setæ. The exopods are, as usual in the males, very powerfully developed, having the basal part broad and compressed; they do not by any means, however, attain such a remarkable length as in the preceding species.

The caudal limbs are developed precisely as in the males of the other species of the genus, constituting powerful natatory organs, with very elongate and multiarticulate branches. In the first pair, however, the inner branch is, as usual, non-articulate, forming an oblong membranous plate, with a short lateral expansion at the base.

The telson (fig. 6) is a trifle longer than the last segment and somewhat slender, as compared with that of the preceding species, with the outer part narrowed and densely fringed with small, slightly unequal, denticles. The apical incision does not fully occupy one-fifth of the length of the telson, and is narrowly rounded at the bottom, as also fringed with numerous short spinules. The terminal lobes are somewhat narrow and obtusely rounded at the tip, and their apical denticles would not seem to exceed in length the lateral.

The uropoda exhibit much the same appearance as in the two Norwegian species *Boreomysis arctica* and *Boreomysis tricornis*, having both plates somewhat more slender than in *Boreomysis scyphops*.

Habitat.—The two specimens contained in the collection were both taken in the North Pacific in the following localities :—

Station 232, May 12, 1875; lat. 35° 11′ N., long. 139° 28′ E. (off coast of Japan); depth, 345 fathoms; green mud; bottom temperature, 41°·1.

Station 252, June 12, 1875; lat. 37° 52′ N., long. 160° 17′ W.; depth, 2740 fathoms; red clay; bottom temperature, 35°·3.

45. *Boreomysis microps*, G. O. Sars (Pl. XXXIII. figs. 7–10).

Boreomysis microps, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 43.

Specific Characters.—Female :—Form of body somewhat more slender than in the preceding species. Frontal margin of carapace arched, with a small pointed projection in the middle. Last caudal segment elongate, tapering. Eyes unusually narrow, almost fusiform, with cornea not in the least expanded, and occupying but a small part of the eye. Antennular peduncle relatively more slender than in *Boreomysis obtusata*. Antennal scale surpassing antennular peduncle by only one-fourth of its length, oblong-linear, apex obtusely truncate, with denticle of outer corner very small. Telson exceedingly slender and greatly narrowed in outer part; lateral edges armed with strong denticles along with numerous much smaller ones; apical incision occupying only from one-seventh to one-eighth of the length of telson, very narrow at bottom; terminal lobes rounded at tip. Length, 24 mm.

Remarks.—The present form may be at once distinguished from the other species of the genus by its unusually small and narrow eyes, a character from which the specific denomination was taken. Moreover, the slender form of the telson would seem to afford a good specific mark.

Description.—Only one specimen, a broken adult female, is comprised in the collection. It has a length of 24 mm., and is thus somewhat smaller than the last species.

The form of the body (see Pl. XXXIII. fig. 7) would appear to be a trifle more slender than in the last species, and the tail is in particular relatively more elongate, as compared with the anterior division.

The carapace is rather large, and exhibits the usual form, with the cervical sulcus very strongly marked, and the posterior edge evenly emarginate in the middle, exposing above a small portion of the last segment of the trunk. The frontal margin (see fig. 8) is evenly arched at the sides, and exhibits in the middle a small pointed projection, the rudiment of a rostrum.

The tail tapers somewhat backwards, and has the last segment very elongate, exceeding in length the two preceding segments taken together.

The eyes (see fig. 8) are comparatively small, and exhibit a form somewhat differing from that in the other species, being narrowly clavate, or almost fusiform, with the cornea not in the least expanded, and occupying but a very small part of the eye. The ocular pigment is, as in the last species, of a reddish colour.

The antennular peduncle (*ibid.*) is somewhat more slender than in *Boreomysis obtusata*, though in other respects exhibiting the usual structure.

The antennal scale (*ibid.*) is less produced than in the two preceding species, projecting, as it does, beyond the antennular peduncle by only one-fourth of its length. It has an oblong-linear form, with the greatest breadth about in the middle, and the apex obtusely rounded, with the denticle of the outer corner very small.

The legs would seem to agree in structure perfectly with those in *Boreomysis obtusata*.

The telson (fig. 9) is exceedingly slender and elongate, exceeding perceptibly in length the last segment, and has the outer part much narrowed. The lateral edges are in the greater part of their length armed with rather strong denticles, having between them a great number of much smaller ones. The apical incision is comparatively short, occupying only from one-seventh to one-eighth of the length of the telson, and rather narrow, having, however, at the bottom a peculiar dilatation (see fig. 10). The edges of the incision are, as usual, coarsely spinulose, and the terminal lobes rounded at the tip.

Of the uropoda the outer plates had been broken off in the specimen examined; the inner plates were very slender, lanceolate, and projected perceptibly beyond the tip of the telson.

Habitat.—The sole specimen described above was taken in the North Atlantic south of Nova Scotia, United States :—

Station 50, May 21, 1873; lat. 42° 8′ N., long. 63° 39′ W.; depth, 1250 fathoms; blue mud; bottom temperature, 38°·0.

Genus 3. *Amblyops*, G. O. Sars, 1872.

Amblyops, G. O. Sars, Monographi over Norges Mysider, Bd. ii.

Generic Characters.—Form of body comparatively thickset. Carapace large, covering greater part of trunk, frontal margin evenly arched, without any trace of a rostral projection. Eyes imperfectly developed, transformed into two immobile plates, extending horizontally in front of the carapace and contiguous in the middle. Antennular peduncle short and thick, with last joint largest; male appendix well developed. Antennal scale with outer edge naked, and jutting out at the end as a dentiform projection. Oral parts of usual structure. Gnathopoda having endopod comparatively poorly developed. Legs subequal, of moderate length, propodal joint subdivided into three articulations, terminal joint unguiform. Marsupial pouch composed of but two pairs of distinctly developed incubatory lamellæ. Sexual appendages in male short and thick, with a transverse row of curved apical bristles. Caudal limbs in male natatory. Telson linguiform, not incised at apex, outer part coarsely spinous at edges. Inner plate of uropoda much shorter than outer.

Remarks.—Of this genus, which is closely allied to the genus *Pseudomma*, G. O. Sars, a single species only, *Amblyops abbreviata*, G. O. Sars, from the Norwegian coast, has hitherto been recorded. Another form, evidently belonging to the same genus, has, however, been taken on the Challenger Expedition in the southern hemisphere, and will be described below.

46. *Amblyops crozetii*, Willemoes-Suhm. MS. (Pl. XXXIII. figs. 11–16).

Amblyops crozetii, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 44.

Specific Characters.—Male:—Form of body somewhat more slender than in the typical species. Carapace almost entirely covering trunk, antero-lateral corners obtusely truncate. Last caudal segment somewhat longer than preceding. Ocular plates rather large, quadrilateral, with a small upturned papillary projection anteriorly. Antennal scale scarcely twice the length of antennular peduncle, somewhat rhomboidal, denticle of outer corner placed well-nigh in the middle of the length of the scale, inner corner projecting as a narrow linguiform lobe. Legs rather slender, terminal part very narrow, with first joint longer than both the others taken together. Telson relatively short, scarcely as long as last segment; apex broadly truncate, and armed with numerous strong spines. Inner plate of uropoda projecting considerably beyond tip of telson, and about half as long as outer; auditory apparatus imperfectly developed. Length, 29 mm.

Remarks.—This form has been briefly recorded by the late Dr. v. Willemoes-Suhm in his manuscript notes, as a new species, under the above appellation, and a drawing

furnished of the animal viewed from above. It may at once be distinguished from the typical species, *Amblyops abbreviata*, G. O. Sars, by the deviating form of the antennal scale and the telson, as also by the remarkably slender legs.

Description.—Only a single specimen of this form, an adult male, was procured on the Expedition. It has a length of 29 mm., and thus considerably exceeds in size the typical species, which attains a length of only 18 mm.

The form of the body (see Pl. XXXIII. figs. 11, 12) is comparatively rather robust, though somewhat less so than in the typical species, with the anterior division but slightly more dilated than the posterior.

The carapace is rather large, covering most of the trunk, and leaving but a small part of the last segment exposed above. The anterior part is marked off by a well-defined cervical sulcus, and somewhat arched above, with the frontal margin forming in the middle a perfectly even curve. The antero-lateral corners of the carapace are obtusely truncate, and the inferior margins rather incurved in the middle.

The tail is cylindrical and anteriorly only a trifle narrower than the anterior part of the carapace. The five anterior segments are nearly uniform in length, whereas the last is rather elongate, almost as long as the two preceding taken together.

The ocular plates are comparatively large, occupying, as they do, the whole breadth of the frontal margin, and are perfectly well defined from each other, though contiguous along their inner edge. They exhibit an irregular quadrilateral form, with the inner side shortest, and forming a right angle with the anterior, which has a short, somewhat upturned, papillary projection in the middle. The edges of the plates are quite smooth, and no trace of any pigment or visual elements could be detected in the specimen examined; though a similar diffuse pink pigment, as in the typical species, may have existed in the specimen, when still fresh.

The antennular peduncle is short and thick, with the terminal joint as large as the two others taken together. The male appendage is comparatively shorter than in the typical species, but furnished with a dense bunch of delicate bristles. The flagella were broken off at a short distance from their bases.

The antennal scale (fig. 13) exhibits an appearance somewhat different from that in the typical species, and is also relatively somewhat shorter, attaining scarcely twice the length of the antennular peduncle. It is somewhat rhomboidal in form, the apex being very obliquely truncate, with the inner corner greatly projecting as a narrow linguiform lobe fringed round with long setæ, whereas the outer corner juts out as a strong dentiform projection, placed almost in the middle of the length of the scale. The basal part of the flagellum is but half as long as the scale, with the middle joint longest; the terminal part was broken in the specimen examined.

The legs (figs. 14, 15) are rather more slender than in the typical species, and very narrow, especially the posterior ones (fig. 15), though still exhibiting the structure

characteristic of the genus, the terminal part being subdivided into three articulations, the first by far the longest, and having besides a distinct, though rather small terminal claw. The exopods are very strongly developed, with exceedingly broad and muscular basal parts.

The caudal limbs are also very powerful, natatory, and agreeing in structure with those in the male of *Amblyops abbreviata*.

The telson (fig. 16) is rather short, attaining scarcely the length of the preceding segment, and differs conspicuously from that in the typical species by the apex being abruptly and broadly truncate, and even slightly emarginate in the middle, not as in that species narrowly rounded. It tapers very slightly, and has the outer part fringed with numerous small denticles, those springing from the apical edge, about fourteen, being somewhat more elongate. Moreover, in the middle of the apical edge is seen a small tubercle, from which issue two slender and diverging setæ.

The uropoda exhibit the usual structure, and have the outer plate rather large, almost twice the length of the inner. The latter is lanceolate, and projects considerably beyond the tip of the telson. The auditory apparatus at the base of this plate would seem to be quite rudimentary, whereas in the typical species it is well developed.

Habitat.—The above described specimen was taken in the Southern Ocean off the Crozet Islands, at a rather considerable depth. The locality is as follows :—

Station 147.—December 30, 1873 ; lat. 46° 16′ S., long. 48° 27′ E. ; depth, 1600 fathoms ; Diatom ooze ; bottom temperature, 34°·2.

Genus 4. *Pseudomma*, G. O. Sars, 1869.

Pseudomma, G. O. Sars, Nye Dybvands—Crustaceer fra Lofoten ; Christiania Vid. Selsk. Forhandl., 1869.

Generic Characters.—Form of body slender, almost cylindrical throughout. Carapace small, not covering by far the whole trunk, frontal margin evenly arched, without any rostral projection. Eyes quite rudimentary, forming merely broad petaloid expansions of the ocular segment, partly connate in the middle, and not exhibiting the slightest trace of pigment or visual elements. Antennular peduncle very short ; male appendage large, conical. Antennal scale more or less obliquely truncate, with inner corner projecting, outer jutting forth as a strong dentiform process. Gnathopoda having endopod powerfully developed, with terminal joint densely hirsute. Legs exceedingly slender and fragile, filiform, increasing in length posteriorly ; propodal joint subdivided into three articulations, terminal joint obtuse and densely hirsute, not unguiform. Sexual appendages of male very narrow, with a single apical bristle. Caudal limbs in male all natatory. Telson linguiform, with apex entire, apical spines elongate. Inner plate of uropoda shorter than outer, with auditory apparatus distinctly developed.

Remarks.—Of this genus, chiefly distinguished by the peculiar rudimentary condition

of the eyes and the extremely slender filiform legs, three northern species have been recorded, viz., *Pseudomma roseum*, G. O. Sars, *Pseudomma affine*, G. O. Sars, and *Pseudomma truncatum*, Smith. Two additional species, to be described below, were met with on the Challenger Expedition, both in the southern hemisphere. They are readily distinguished from each other by the form of the ocular plates and the antennal scale, as follows :—

Ocular plates with upper face plane and outer edge serrate. Antennal scale oblong, with inner corner only slightly projecting; spine of outer corner far removed from base, ... *P. sarsii*, Suhm.

Ocular plates divided by a longitudinal ridge, outer edge smooth. Antennal scale lanceolate, with inner corner greatly projecting; spine of outer corner placed close to base, ... *P. australe*, G. O. Sars.

47. *Pseudomma sarsii*, Willemoes-Suhm, MS. (Pl. XXXIV. figs. 1–3).

Pseudomma sarsii, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 46.

Specific Characters.—Form of body very slender. Carapace evenly emarginate behind, leaving the two posterior segments of trunk uncovered above. Last caudal segment longer than preceding. Ocular plates occupying almost the whole breadth of frontal margin, obtusely truncate anteriorly, outer edge partly serrate, upper face plane. Antennal scale oblong, with denticle of outer corner not far distant from apex, inner corner but slightly projecting and bluntly rounded. Telson about as long as last segment, linguiform, apex broadly rounded and armed with ten strong spines, the six innermost rather long; lateral denticles very small. Uropoda of usual structure. Length, 14 mm.

Remarks.—This form was recorded by the late Dr. v. Willemoes-Suhm in his manuscript notes, under the above given name, and a figure added of the animal as viewed from above. It is closely allied to the typical species, *Pseudomma roseum*, G. O. Sars, or perhaps still more to the Arctic form, *Pseudomma truncatum*, Smith, but may readily be distinguished from both by a somewhat deviating form of the antennal scale and by the armature of the telson.

Description.—The usual length of this form would seem to be about 14 mm., or somewhat less than that of *Pseudomma roseum*. There is, however, in the collection a single very mutilated specimen from the Antarctic Ocean, which is rather larger in size.

The form of the body (see Pl. XXXIV. fig. 1) is very slender, and rather similar to that of *Pseudomma roseum*, being nearly cylindrical throughout, with the anterior division but slightly dilated.

The carapace is comparatively small and narrow, not nearly covering the whole

trunk, two segments of which are partly exposed behind the posterior emargination. The anterior third part of the carapace is marked off by a well-defined and rather deep cervical sulcus, and terminated with an evenly-arched frontal margin. The antero-lateral corners are but very slightly produced, and obtuse-angled.

The tail is about twice as long as the carapace, and very slender, cylindrical, tapering scarcely at all posteriorly, with the last segment much longer than the others.

The ocular plates are comparatively broad, and quite plane, extending horizontally in front of the carapace, and occupying nearly the whole breadth of the frontal margin. They are obtusely truncate in front, and separated in the middle by a very small cleft. The outer edge is slightly arcuate, and finely serrate along its anterior part, forming, together with the anterior edge, an obtuse angle. As in the other species, no trace of pigment or any visual elements can be detected; but the optic nerve forms, within the ocular plate, a ramification exactly similar to that described by the author in *Pseudomma roseum*.

The antennular peduncle exhibits the usual form, being very short and thick, with the last joint longer than the two others taken together. The male appendage is somewhat shorter than the last joint of the peduncle, and provided with the usual dense bunch of hairs.

The antennal scale (fig. 2) is about twice as long as the antennular peduncle, and of an oblong form, about three times as long as broad. The apex is somewhat obliquely truncate, though not nearly to such an extent as in the other known species, and the inner corner therefore appears but slightly produced and bluntly rounded. The denticle of the outer corner is rather strong, and placed much nearer to the apex of the scale than in any of the other species.

The endopodal parts of the legs, as also the terminal parts of the antennular and antennal flagella, were broken off in all the specimens preserved.

The telson (fig. 3) has about the length of the last caudal segment, and exhibits a somewhat linguiform shape, being broadest at the base and tapering regularly toward the apex, which is broadly rounded or almost truncate. The lateral edges are armed in their outer part, on either side, with about eight very small denticles, and from the apical edge issue ten much larger denticles, increasing in size inwards, and assuming the character of strong spines; moreover, a small tubercle occurs in the middle, as in the other species, bearing two very delicate and diverging bristles. As regards form, the telson of the present species bears most similarity to *Pseudomma truncatum*, Smith, but in that species the number of the terminal spines is much less, viz., not over six. *Pseudomma affine*, G. O. Sars, on the other hand, has no less than twelve terminal spines, but in that form the apical edge is not distinctly defined from the lateral ones.

The uropoda exhibit the usual form, and have the auditory apparatus within the base of the inner plates distinctly developed.

Habitat.—Of this form, which may be regarded a representative species of the genus in the southern hemisphere, several specimens were collected off the Kerguelen Islands, at a depth of 120 fathoms. A single and much larger, though rather mutilated specimen, apparently of the same species, was taken in the Antarctic Ocean from a rather considerable depth. The locality is:—

Station 153, February 14, 1874; lat. 65° 42′ S., long. 79° 49′ E.; depth, 1675 fathoms; blue mud.

48. *Pseudomma australe*, G. O. Sars (Pl. XXXIII. figs. 17, 18).

Amblyops australis, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 45.

Specific Characters.—Ocular plates comparatively smaller than in the preceding species, not occupying the whole breadth of the frontal margin, outer edge smooth, and forming, along with anterior, a projecting corner, from which a longitudinal keel runs across the plate, dividing it into an upper and a lateral area, the latter somewhat hollowed. Antennular peduncle short and robust. Antennal scale twice the length of the antennular peduncle, rather narrow, lanceolate, setose on both edges, spine of outer margin placed close to base of scale.

Remarks.—Of this species only a fragment—the most anterior part of the body—was found in the collection. This fragment shows, however, some very striking peculiarities, fully warranting the establishment of a new species. I formerly referred it to the genus *Amblyops*, but now find it, on closer examination, more properly referable to the genus *Pseudomma*, the structure of the ocular plates being more in accordance with that in the latter genus.

Description.—The fragment—comprising the anterior part of the carapace, together with the ocular plates, the antennulæ and antennæ—had evidently belonged to a full-grown male specimen. The length of the animal may have probably been about 10 mm.

The carapace is rather broad anteriorly, with the frontal margin forming an even curve, and the antero-lateral corners almost right-angled.

The ocular plates (see fig. 17) do not occupy the whole breadth of the frontal margin, and exhibit, moreover, a form somewhat deviating from that in the preceding species. They are, as in that species, truncate anteriorly, and partly separated in the middle by a short and narrow sinus or cleft, but have the outer edge quite smooth, and forming, along with the anterior edge, a somewhat projecting corner. From the latter a longitudinal keel runs across the plate dividing it into an upper part, which is nearly plane, and a lateral one, distinctly hollowed along the middle (see fig. 18). As in the preceding species, no trace whatever of pigment or any visual elements can be detected.

The antennular peduncle has much the same appearance as in the last species, being

comparatively short and thick, with the last joint by far the largest. The male appendage also exhibits a very similar aspect.

The antennal scale (see fig. 17), on the other hand, looks very dissimilar, resembling rather that occurring in the species of the genus *Mysidopsis*. It is about twice as long as the antennular peduncle, and exhibits a very narrow, lanceolate form, with both margins apparently fringed with setæ in their whole length. On closer examination, however, a dentiform projection is seen issuing from the outer edge, at a very short distance from the base, and the part of the edge behind this projection does not exhibit any setæ. Thus, the scale is, in reality, formed upon the same type as that in the other species of the present genus, but is truncate obliquely to such an extreme degree, that the inner linguiform-produced corner occupies well nigh the whole length of the scale, whereas the outer corner has withdrawn to very near the base. The basal part of the flagellum is somewhat more produced than in the preceding species, being not much shorter than the scale, and has the last joint the longest. The terminal part of both this flagellum and those of the antennulæ had been broken off near their bases.

Habitat.—The above-described fragment I found in a bottle containing several larvæ of Decapoda and other Crustacea, taken off the entrance to Port Philip, Bass Strait. The locality is given below, as follows :—

Station 161, April 1, 1874 ; lat. 38° 22′ S., long. 144° 36′ E.; depth, 33 fathoms ; sand.

Genus 5. *Anchialus*, Kröyer, 1861.

Anchialus, Kröyer, Nat. Hist. Tidsskr., 2^{den} Række, Bd. i.

Generic Characters.—Form of body somewhat different in the different species. Carapace more or less developed, with frontal margin produced in the middle. First caudal segment in female with small horizontally projecting epimera. Eyes normally developed. Antennular peduncle with male appendage very small, tuberculiform ; outer flagellum forming a lamellar expansion at base. Antennal scale remarkably small, shorter than basal part of flagellum, apex obliquely truncate. Legs subequal, densely setiferous, with terminal part subdivided into a more or less considerable number of short articulations, terminal claw quite obsolete. Caudal limbs in female partly obsolete, in male well developed, natatory. Telson large, incised at apex. Inner plate of uropoda scarcely shorter than outer ; auditory apparatus distinctly developed.

Remarks.—This genus, first established by Kröyer, is chiefly characterised by the rudimentary condition of the antennal scale, the presence in the female of a pair of small but distinct epimera on the first caudal segment, and the peculiar reduction of some of the caudal limbs in the female, finally by the form and large size of the telson. Besides the three species described below, a fourth, *Anchialus agilis*, has been recorded by the

author from the Mediterranean. The species of this genus would seem to lead a pelagic existence, most of them being met with at the surface of the sea.

The following is a synopsis of the Challenger species :—

Carapace with posterior edge	straight.	Frontal plate abruptly truncate,	*A. typicus*, Kröyer.
	emarginate, exposing	the two posterior segments of trunk. Frontal plate triangular, acutely pointed at tip,	*A. angustus*, G. O. Sars.
		none of the segments of trunk. Frontal margin only slightly projecting in the middle,	*A. pusillus*, G. O. Sars.

49. *Anchialus typicus*, Kröyer (Pl. XXXIV. figs. 4–24).

Anchialus typicus, Kröyer, Et Bidrag til Kundskab om Krebsdyrfamilien Mysidæ; Nat. Hist. Tidsskr., 2den Række, Bd. i. p. 53, Tab. ii. figs. 7, *a–l*.

Mysis moebii, Dohrn, Untersuchungen über Bau und Entwickelung der Arthropoden, II.; Zeitschr. f. wiss. Zool., Bd. xxi., 1871, p. 359, Tab. xxvii., xxviii. figs. 11–22.

Anchialus truncatus, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 47.

Specific Characters.—Form of body short and thickset. Carapace large, covering whole of trunk, posterior margin straight. Frontal plate abruptly truncate at tip. Last caudal segment a trifle longer than preceding. Eyes thick, claviform, cornea slightly expanded, with light yellowish pigment. Antennular peduncle short and stout, with middle joint cup-shaped. Antennal scale exceedingly minute, rhomboidal, denticle of outer corner obsolete. Gnathopoda very strong, with carpal joint in male projecting at the inner edge as a pointed process. Legs comparatively short, with terminal part very small, and divided into four to five articulations; first pair in male having terminal part dilated in the middle and armed with peculiar slender spines. Caudal limbs in female distinctly developed on first segment only, those of male, strong, with basal lobe of inner branch very broad, lamellar; outer branch of fourth pair but slightly produced. Telson very large, oblong linear, apical incision occupying one-seventh of the length. Uropoda with inner plate somewhat larger than outer, and having the auditory apparatus but slightly developed; outer plate with exterior edge armed with a row of small denticles. Marginal setæ of both plates very small. Length, 9 mm.

Remarks.—I recorded this form in my Preliminary Notices as a new species under the name of *Anchialus truncatus*, but now believe it to be identical with the *Anchialus typicus* of Kröyer. The figures given by that author do not, it is true, correspond exactly with the form examined by myself; but I think this may be merely accounted for by the imperfect drawings given by Kröyer. His description would seem, for the most part, to accord with the present species. I cannot but believe that the form recorded by Dohrn as *Mysis moebii* belongs to this species. As regards the Mediterranean species, *Anchialus agilis*, G. O. Sars, the similarity to the present form, both in the

external appearance and the structural details, is very striking. But, as the frontal plate exhibits in both a totally different form, and the eyes, moreover, in the present form have a very light pigment, whereas it is dark in the Mediterranean form, I prefer nevertheless to regard both as distinct, though very closely allied species.

Description.—The length of the body of the adult female is about 9 mm., that of the male somewhat less.

The form of the body (see Pl. XXXIV. figs. 4–6) is remarkably short and thickset, with the anterior division rather dilated, the posterior much more slender and cylindrical in form.

The carapace is comparatively very large, covering, besides the whole of the trunk, also the anterior part of the first caudal segment. Its posterior margin, contrary to what generally occurs in the Mysidæ, is quite straight, without exhibiting the slightest trace of the usual emargination in the middle; and the lateral parts or wings are very deep posteriorly, with their edges forming a strong curve. Anteriorly the carapace tapers somewhat, and exhibits here the usual cervical sulcus, which is, however, not particularly deep. The frontal margin juts forth in the middle as a rather broad, horizontally extending plate, abruptly truncate at the tip (fig. 7), not, as in the Mediterranean species, acutely pointed. The antero-lateral corners of the carapace are but slightly produced and almost right angled.

The first caudal segment exhibits in the female (see figs. 4, 5), on either side, a narrow plate, arching over the corresponding limbs, and apparently representing a kind of epimera. These plates are, however, wanting in the male (fig. 6). The other segments are simple cylindrical, and the last of them somewhat longer than the rest.

The eyes are comparatively short and thick, claviform, with the cornea slightly expanded, and occupying about the outer half of the eye. The ocular pigment in all the Challenger specimens, as also in those examined by Kröyer, is very light yellowish, whereas in the Mediterranean form it is of the usual dark hue.

The antennular peduncle (fig. 8) is rather thick and somewhat dilated toward the end, with the second joint exhibiting a rather peculiar, as it were, cup-shaped form, being apparently hollowed out anteriorly to receive the base of the terminal joint. The latter is about as long as the basal, and exhibits in the male on the lower face a very short knob-shaped lobe, clothed with a dense bunch of delicate hairs. Of the flagella, the outer, as usual, is the longer, and exhibits at the base a short lamellar expansion bearing a dense row of curved sensory bristles.

The basal part of the antennæ (see fig. 9) is rather thick and massive, and armed interiorly, at the base of the flagellum, with a strong denticulate spine. The scale, on the other hand, is exceedingly small, so as scarcely to be visible when the animal is viewed from above (fig. 5). It exhibits a somewhat rhomboidal form, the apex being obliquely truncate, with the inner corner slightly projecting and rounded off, the outer

forming an obtuse angle, without any distinct tooth. The proximal part of the flagellum projects widely beyond the scale, and has the middle joint by far the largest, the last very short.

The anterior lip (fig. 10) is chiefly distinguished by its projecting anteriorly as an exceedingly long and sharply pointed spine, denticulate at the edges.

The posterior lip (fig. 11) has its terminal lobes narrowly rounded in front, and finely ciliate at the tip.

The mandibles (fig. 12) are developed in the usual manner, and have the armature of their cutting edges (fig. 13) rather strong and somewhat different on the two mandibles. The palp (see fig. 12) is rather large, with the middle joint lamellar, the last of oval form and furnished with a double row of delicate bristles.

The first pair of maxillæ (fig. 14) have the outer dentiferous lobe sharply incurved, with a slight angular bend in the middle; the inner lobe is rather small and quite membranous, bearing at the edge several strong setæ. The exognath is distinctly visible in the form of a narrow lamellar expansion of the basal part, densely ciliate at the edge.

The second pair of maxillæ (fig. 15) exhibit quite a normal structure. The last joint of the palp is comparatively small and of an oval form, with the outer edge naked. The exognath is rather large, elliptical, and fringed with about thirteen strong plumose setæ, the posterior of which issues at some distance from the rest, and is more sharply curved.

The maxillipeds (fig. 16) are very strong, with the basal section clearly composed of two very broad segments—the coxal and basal,—the former bearing exteriorly the lanceolate epipodite, the latter exteriorly the exopodite, interiorly the strongly curved, five-jointed endopodite, or palp. The terminal joint of the latter is very small and armed with a strong curved claw; the four others are nearly uniform in size. No true masticatory lobe can be detected at the inner corner of the basal section.

The gnathopoda (fig. 17) exhibit quite an unusually robust structure, especially in the male, and bear a much closer resemblance to the maxillipeds than to the true legs. The basal part is very broad and muscular, and the carpal joint exhibits in the male a strong triangular expansion of the inner edge, to which the terminal part admits of being opposed.

The true legs (fig. 19) are comparatively short, and in the female uniform in structure, with the terminal part remarkably small, not attaining by far the length of the preceding (carpal) joint, and composed of only four articulations, the last of which is quite rudimentary and almost hidden between the bristles issuing from the preceding articulation; in the posterior pair this part (fig. 20) is a trifle more elongate, and has one articulation more than in the rest. In the male the first pair of legs (fig. 18) are peculiarly modified, the terminal part being rather dilated in the middle, and bearing

from ten to twelve peculiar slender spines, forming together a dense fascicle. In all the legs the basal part is rather fully developed and muscular, and the exopod very powerful, with broad and lamellar basal section and eleven-articulated terminal part.

The marsupial pouch in the female specimens (figs. 4, 5) was very large and protruding, and filled with numerous ova or embryos. It is composed of three pairs of incubatory lamellæ, originating from the bases of the three posterior pairs of legs. Of these lamellæ, the anterior pair are rather small, whereas the posterior are exceedingly large and curved.

The outer sexual appendages of the male (fig. 21) are slightly curved, and have at the tip a transverse row of small sharply curved bristles.

Of the caudal limbs in the female, only the first pair (see fig. 22) are developed in the usual manner, having the form of narrow stems, somewhat geniculate in the middle, and supplied with a few short bristles. On the four succeeding segments the limbs are represented by broad, immobile plates, contiguous in the middle, and closely applied to the ventral face, so as easily to be overlooked. These plates, which appear merely as expansions of the sternal parts of the segments, have their edges somewhat angular, and fringed with a few small bristles and short denticles.

In the male, all of the caudal limbs are modified to powerful natatory organs, with broad and muscular basal parts and multiarticulate setiferous branches, the inner of which exhibits at the base a remarkably broad and lamellar lateral expansion. In the first pair (fig. 23) the terminal part of the inner branch is wholly wanting, but its lamellar expansion still remains in its place. The fourth pair (fig. 24) are distinguished by the outer branch being somewhat more produced than in the other pairs, and having the outer articulations armed with short spines, instead of the usual natatory setæ; the antepenultimate articulation of this branch is, moreover, produced on the outer side as an acute-angled process (see fig. 25).

The telson (fig. 26) is very large, fully as long as the two preceding segments taken together, and exhibits an elongate, almost linear form, its length being about three times as great as its breadth. The lateral edges are almost quite straight and parallel, and armed with a great number of small denticles, more crowded in the outer part. The apex is cleft in the middle by a rather narrow incision, occupying about one-fifth of the length of the telson, and the terminal lobes are obtusely pointed and provided at the tip with a single denticle somewhat stronger than the lateral ones; their inner edges are throughout fringed with very fine spinules.

The uropoda (fig. 27) are highly distinguished by the very slight development of the marginal setæ on the terminal plates, whereas both of the latter are partly spinous at the edges. The inner plate is somewhat larger than the outer, and reaches the tip of the telson; it tapers regularly toward the apex, without exhibiting any conspicuous tumefaction at the base, owing to the very slight development of the auditory apparatus; its

inner edge is coarsely spinous throughout, the spines being somewhat unequal in size, and more especially the two apical ones rather large. The outer plate exhibits a form very similar to that of the inner, but is somewhat shorter, and has the outer edge fringed with a row of rather small, equal-sized denticles, the posterior of which, however, issuing from the tip of the plate, is somewhat stronger than the rest and slightly incurved.

As regards colour, the specimens preserved in spirit exhibit a light brownish hue, and have, moreover, a rather conspicuous dendritic pigmentary deposit on either side of the carapace behind the cervical sulcus.

Habitat.—Several specimens of this form, both males and females, were taken at the surface of the sea off Cape of Good Hope. The locality is given as follows:—

Station 141, December 17, 1873; lat. 34° 41′ S., long. 18° 36′ E.

The specimens examined by Kröyer were collected in the tropical part of the Atlantic, in lat. 14° N.; those examined by Professor Dohrn were derived from the Museum at Kiel, and stated to have been procured during the cruise of the Danish frigate "Galathea" —the locality was not recorded.

50. *Anchialus angustus*, G. O. Sars (Pl. XXXV. figs. 1–18).

Anchialus angustus, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 48.

Specific Characters.—Form of body slender and elongate. Carapace narrow, evenly emarginate posteriorly and not covering the trunk completely. Frontal margin jutting out in the middle as an acute triangular projection, and forming on either side between eye and base of antennæ a similar triangular lobe; antero-lateral corners rather broad and projecting, acuminate at tip. Tail slightly tapering, anterior segment in female with distinctly projecting epimera, last segment rather elongate. Eyes narrow, well-nigh cylindrical, cornea scarcely expanded. Antennular peduncle more slender than in preceding species. Antennal scale of a similar appearance to the one in that species, but having the denticle of the outer corner distinctly developed. Gnathopoda less robust. Legs having terminal part very slender and subdivided into seven articulations. The two posterior pairs of caudal limbs in female imperfectly developed; outer branch of fourth pair in male greatly produced, styliform. Telson very similar to that in *Anchialus typicus*, but somewhat narrower. Inner plate of uropoda having auditory apparatus well developed, outer plate about the same length, with only two spines, placed close together in the middle of outer edge, terminal section linguiform. Marginal setæ on both plates well developed. Length, 10 mm.

Remarks.—This is a very distinct species, and at once distinguished from the preceding by its slender form and comparatively small and narrow carapace. It also exhibits several differences in its anatomical details, though evidently belonging to the same genus.

Description.—Of this form three specimens were found in the collection, two adult

females (one of which has been mounted on a glass slide) and a broken male specimen, which I thought it right to dissect for anatomical purposes. The length of the adult female is 10 mm., that of the male about the same.

The form of the body (see Pl. XXXV. figs. 1, 2) is much more slender and elongate than in the typical species, and somewhat resembling that generally met with in the species of *Mysis;* the anterior division being very slightly dilated and about half as long as the posterior.

The integuments exhibit a peculiar, and, as it were, squamous sculpturing, most conspicuous on the ocular pedicles and the basal parts of the several limbs.

The carapace is comparatively small and narrow, contrary to what is found in the typical species, not nearly covering the whole surface of the trunk, two segments of which are exposed behind. It has, moreover, the posterior edge evenly emarginate in the middle, and tapers anteriorly in such manner that its most anterior part does not exceed in breadth the first caudal segment. The frontal margin juts out in the middle between the eyes as an acute triangular projection, and forms, moreover, on either side, a similar triangular lobe, projecting between each of the eyes and the base of the antennæ. The antero-lateral corners (see fig. 3) are rather broad and acuminate at the tip, and the inferior margins of the carapace form at the side of the oral parts a very conspicuous sinus.

The tail is rather slender, cylindrical, though slightly tapering posteriorly. The first segment exhibits in the female, as in the preceding species, on either side, a narrow elliptical vaulted plate or epimeron, and the last segment is rather elongate, about as long as the two preceding segments taken together.

The eyes are much narrower than in the preceding species, almost cylindrical, with the cornea scarcely at all expanded, and not fully occupying the outer half of the eye. The ocular pigment is of the usual dark hue.

The antennular peduncle (fig. 4) is less robust, with the second joint quite of a normal form, the last regularly cylindrical, scarcely at all dilated at the end. The outer flagellum has a similar lamellar expansion at its base to that of the typical species, and the male appendage would also seem to be quite similar.

The antennal scale (see fig. 5) exhibits an appearance very nearly agreeing with that in *Anchialus typicus*, but is a trifle larger, having the denticle of the outer corner distinctly developed, as also the marginal setæ much coarser. A suture is seen to run across the scale in close proximity to the inner corner, marking off an obtusely triangular terminal articulation, to which seven of the marginal setæ are affixed. The proximal part of the flagellum projects, as in the preceding species, considerably beyond the scale, but has the terminal joint comparatively larger than in that form, and the basal spine would seem to be somewhat smaller and quite smooth.

The oral parts, though developed upon the same type as in the preceding species, still exhibit in their structural details well-marked specific differences.

Thus, the spine issuing anteriorly from the anterior lip (fig. 6) is relatively much shorter, and the terminal lobes of the posterior lip (fig. 7) are obtusely truncate in front.

The mandibles (fig. 8) are chiefly distinguished from those in the typical species by the terminal joint of the palp being more elongate and narrow.

On the first pair of maxillæ (fig. 9) the outer lobe is more regularly curved, and the rudimentary exognath somewhat shorter. On the second pair (fig. 10) the terminal joint of the palp slightly differs in form, being comparatively shorter and broad in the middle, and having, moreover, a dense fringe of delicate cilia along the outer edge.

The maxillipeds (fig. 11) are comparatively less robust, and have at the inner corner of the basal part a distinct, densely setiferous masticatory lobe. The last joint of the endopodite is triangular, and its apical spine shorter than in *Anchialus typicus*. The epipodite, on the other hand, would seem to be comparatively larger.

The gnathopoda (fig. 12) are also much more slender than in the preceding species, and agree more in structure with those in other Mysidans.

The legs (fig. 13) are densely setose, especially along their inner edge, the setæ exhibiting a conspicuous fascicular arrangement. The terminal part is rather produced and very narrow, exceeding in length the preceding (carpal) joint, and is, moreover, subdivided into a rather great number of short articulations, no less than seven being counted on the middle pairs. The first pair of legs in the male do not seem in this form to exhibit any difference from those in the female.

Of the caudal limbs in the female, the three anterior pairs are developed in the usual manner, whereas the two posterior are represented merely by laminar expansions of the sternal parts of the segments, as is in the preceding species the case with all saving the first pair.

In the male, all the caudal limbs are natatory, but differ from those in the male of *Anchialus typicus* by the basal expansion of the inner branch being far less developed (see figs. 14, 15). Moreover, the outer branch of the fourth pair (fig. 16) is greatly produced, styliform, and composed of eleven articulations, the six outer of which are armed with spines instead of natatory setæ. Of the articulations of this branch the antepenultimate is much produced, and bears at the end, exteriorly, a rather elongate spine; the two succeeding articulations, on the other hand, are very small, and the last of them has two short apical spines.

The telson (fig. 17) exhibits an appearance very similar to that in the typical species, being, however, somewhat narrower and slightly tapering toward the apex, with twenty to thirty lateral denticles on either side. The apical incision occupies about one-sixth of the length of the telson, and has a form perfectly similar to that in *Anchialus typicus*. The terminal lobes bear a rather elongate apical spine, and are densely fringed along their inner edge with rather strong spinules.

The uropoda (fig. 18) have both plates of nearly equal length, and, contrary to what is the case in the typical species, are fringed with rather elongate plumose setæ. The inner plate has, moreover, the inner edge, beneath the marginal setæ, armed with numerous unequal spines, some of which—disposed at regular intervals—are rather long. The auditory apparatus within the base of this plate is much more fully developed than in *Anchialus typicus*, the otolith being rather large and of a rounded oval form. The outer plate is armed with only two spines issuing from a ledge-like projection at about the middle of the exterior edge, and has the outer part linguiform and setose all round.

Habitat.—The three above-mentioned specimens were all collected in the same locality, at the entrance of Port Philip, South Australia. The locality is given below as follows :—

Station 161, April 1, 1874; lat. 38° 22′ S., long. 144° 36′ E.; depth, 33 fathoms; sand.

51. *Anchialus pusillus*, G. O. Sars (Pl. XXXV. figs. 19, 20).

Promysis (?) *pusilla*, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 54.

Specific Characters.—Form of body rather short, with anterior division considerably dilated, tail very narrow. Carapace completely covering the trunk, slightly emarginate posteriorly; frontal margin forming in the middle an obtuse angle, antero-lateral corners obtusely rounded. Last caudal segment remarkably elongate. Eyes slightly expanded at apex with dark pigment. Antennular peduncle rather stout, outer flagellum very elongate. Antennal scale less rudimentary than in the other species, denticle of outer corner well defined. Legs slender, with terminal part short, triarticulate. Caudal limbs in female very small, almost obsolete. Telson elongate, scarcely shorter than uropods. Length, 3 mm.

Remarks.—I have recorded this form in my Preliminary Notices as a species of the genus *Promysis*, Dana. On closer examination I have, however, found this to be incorrect, and now believe that it should more properly be referred to the genus *Anchialus*, exhibiting, as it does, several characters in common with the latter genus, not to be met with in the former. My examination of the species has not been so close as could be wished, since both the specimens in the collection were mounted in Canada balsam on a glass slide, and in such a position as not to admit of examining all the parts satisfactorily.

Description.—Both the specimens in the collection are females, with greatly developed marsupial pouches, and thus may be assumed to have attained their full size. Notwithstanding this, their length does not exceed 3 mm., and this form may accordingly be regarded as a true dwarf Mysidan.

The form of the body (see Pl. XXXV. fig. 19) is comparatively short, with the anterior division considerably dilated, whereas the tail is exceedingly narrow.

The carapace is rather large, completely covering the trunk, no segments of which appear exposed. It is very slightly emarginate posteriorly and has rather a deep cervical sulcus, marking off its anterior part. The frontal margin is evenly arched at the sides, and forms in the middle a slight angular projection. The antero-lateral corners are but slightly produced and obtusely rounded.

The caudal segments are somewhat depressed and of uniform breadth, being much narrower than the anterior part of the carapace. The last segment is remarkably elongate, almost as long as the three preceding ones taken together.

The eyes are claviform, with the cornea somewhat expanded, and exhibiting a dark coloured pigment.

The antennular peduncle is comparatively very powerfully developed, about half as long as the carapace, and has the last joint distinctly the largest. Of the flagella, the outer one is remarkably elongate, almost equalling the whole body in length.

The antennal scale (see fig. 20) would seem to be constructed upon the same type as in the two preceding species, being rather short as compared with that in most other Mysidans, though not quite so rudimentary as in the other species of the genus, reaching, as it does, to about the middle of the antennular peduncle. The apex is somewhat obliquely truncate, with the denticle of the outer corner well defined. The basal part of the flagellum projects beyond the tip of the scale, as in the two preceding species, and has the middle joint by far the largest.

The legs appear to be rather slender, but have the terminal part comparatively short, and composed of only three articulations.

The marsupial pouch was greatly developed in both specimens, forming a very large, almost semiglobular prominence issuing from beneath the posterior part of the trunk.

The caudal limbs would seem to be exceedingly small, well nigh obsolete.

The telson is rather elongate and narrow, but its form could not be exactly made out in the specimens examined.

The uropoda have both plates about equal, and fringed with long setæ. The auditory apparatus within the base of the inner plate is distinctly developed.

Habitat.—The two specimens in the collection were taken in the Celebes Sea, October 22, 1874; lat. 5° 44′ N., long. 123° 34′ E.; at Station 199, most probably at the surface of the sea.

Genus 6. *Mysidopsis*, G. O. Sars, 1864.

Mysidopsis, G. O. Sars, Beretning om en i Sommeren 1863 foretagen zoologisk Reise, Nyt Magazin f. Naturvid., 1864.

Generic Characters.—Carapace comparatively small, not completely covering the trunk; frontal margin more or less produced in the middle. Eyes well developed,

pyriform. Antennular peduncle of usual form; male appendage rather large. Antennal scale lanceolate, setose on both edges, with a short apical articulation. Mandibles without any distinct molar protuberance. First pair of maxillæ with inner lobe very small; second pair wanting the inner setiferous expansion of the basal part; terminal joint of palp oblong, not incurved; exognath very narrow. Maxillipeds and gnathopoda powerfully developed. Legs subequal, comparatively short and stout, with the joints partly appressed, propodal joint subdivided into three articulations, terminal joint having a slender, setiform claw. Marsupial pouch composed of three pairs of incubatory lamellæ, anterior pair very small. Male sexual appendages short and thick. Caudal limbs in male all natatory. Telson comparatively short, subtriangular, apex entire, or cleft. Uropoda with inner plate much shorter than outer; auditory apparatus well developed.

Remarks.—This genus, established by the author as early as 1864, is chiefly characterised by the form of the antennal scale, the structure of the mandibles and of the maxillæ, the comparatively robust form of the legs, finally by the form of the telson. From the genus *Mysis*, to which it has some resemblance in its general aspect, it is easily distinguished by the caudal limbs in the male being all natatory. To the genus *Promysis* of Dana it would seem to be nearly allied, if not actually the same. But, as Dana says that the terminal part ("tarsus") of the legs in *Promysis* is not subdivided, whereas in all species of the genus *Mysidopsis* it is distinctly triarticulate, I have not felt warranted in identifying the two genera. Moreover, the species of the genus *Promysis* are pelagic, whereas those of *Mysidopsis* are true bottom forms.

Three northern species, viz., *Mysidopsis didelphys*, Norman, *Mysidopsis gibbosa*, G. O. Sars, and *Mysidopsis angusta*, G. O. Sars, have hitherto been recorded, and on the Challenger Expedition a fourth species, apparently belonging to the present genus, has been procured and will be described below.

52. *Mysidopsis incisa*, G. O. Sars (Pl. XXXV. figs. 21–23).

Mysidopsis (?) incisa, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 49.

Specific Characters.—Form of body rather slender. Carapace small, exposing the two posterior segments of trunk, frontal margin but slightly projecting in the middle. Last caudal segment longer than preceding. Eyes large, cornea much expanded and deeply emarginate above. Antennal scale narrowly lanceolate. Legs comparatively feeble, with the joints only slightly expanded. Telson shorter than last segment, lateral edges denticulate throughout, apex deeply cleft, incision occupying about one-fourth of the length of the telson and bordered with delicate spinules; terminal lobes pointed, with apical spines not stronger than lateral denticles. Length, 8 mm.

Remarks.—I have felt warranted in referring this form to the genus *Mysidopsis*,

since in most respects it would seem to agree pretty well with that genus. The telson, it is true, has the apex not entire as in the typical species, *Mysidopsis didelphys;* but there is another species, undoubtedly belonging to this genus, viz., *Mysidopsis angusta*, which likewise has the telson cleft at the tip, although the borders of the incision in that species are smooth, and not spinulose.

Description.—Of the present form only a single mutilated specimen, an adult female, was found in the collection. It has a length of about 8 mm.

The form of the body (see Pl. XXXV. fig. 21) is comparatively slender, about as in the northern form *Mysidopsis angusta*, but with the anterior division somewhat more dilated.

The carapace, as in the other species of this genus, is rather small, not nearly covering the whole of the trunk, the two posterior segments of which appear almost wholly exposed behind. Its anterior third is marked off by a well-defined cervical impression, and is slightly arched above. The frontal margin forms only a very slight angular projection in the middle, and the antero-lateral corners are obtusely rounded.

The caudal segments are all regular cylindrical, and the last of them somewhat longer than the rest.

The eyes are comparatively large and slightly flattened, with the cornea much expanded and deeply emarginate above. The ocular pigment is of the usual dark hue.

The antennular peduncle does not attain any considerable length, and exhibits the usual structure. Both of the flagella were broken near their bases.

The antennal scale (fig. 22) projects only beyond the antennular peduncle by about one-fourth of its length, and exhibits a narrow lanceolate form, with both margins setiferous throughout their whole length. The apical articulation is rather small, and bears four of the marginal setæ. The proximal part of the flagellum is much shorter than the scale, and has the middle joint largest. The terminal part was broken in the specimen examined.

Of the legs only one of the second pair remains in the specimen. Its structure would seem to agree perfectly well with that in the other species, except that the joints are somewhat less expanded.

The two posterior pairs of incubatory lamellæ composing the marsupial pouch are seen in the fig. 21 ; the anterior rudimentary pair would seem to have been thrown off along with the corresponding legs.

The caudal limbs do not exhibit any peculiarities in their structure.

The telson (see fig. 23) is somewhat shorter than the last caudal segment, and exhibits the usual triangular form, being broadest at the base and tapering rapidly toward the apex, with the lateral edges almost straight, and armed on either side with close upon sixteen small denticles, disposed throughout their whole length. The apex is not, as in

the typical species, entire, but deeply cleft in the middle, the incision being rather narrow, and occupying about one-fourth of the length of the telson. The terminal lobes are pointed and densely spinulose at their inner edge, and also furnished at the tip with a few denticles of the same appearance as those occurring along the lateral edges.

The uropoda (see fig. 23) had the terminal part of both plates broken off in the specimen examined, and their respective lengths cannot therefore be given. The auditory apparatus within the base of the inner plate is well developed, with the otolith rather large and globular.

Habitat.—The above described specimen was taken at the entrance of Port Philip, South Australia, along with the specimens of *Anchialus angustus*. The locality is :—

Station 161, April 1, 1874; lat. 38° 22′ S., long. 144° 36′ E.; depth, 33 fathoms; sand.

Genus 7. *Siriella*, Dana, 1852.

Siriella, Dana, United States Exploring Expedition, Crustacea, pt. i.
Cynthia, Thompson (male).

Generic Characters.—Form of body more or less slender. Carapace very small, not nearly covering the whole of the trunk; frontal margin produced in the middle. Eyes normally developed. Antennular peduncle rather elongate; male appendage but slightly prominent, issuing from lower face of terminal joint. Antennal scale with outer edge naked, and terminating in a small dentiform projection, apex obliquely truncate. Mandibles with molar protuberance imperfectly developed. Second pair of maxillæ having but two masticatory lobes; terminal joint of palp large and oblong, not incurved. Legs subequal, rather stout, with propodal joint entire or subdivided into two articulations only, and having a double row of densely crowded apical bristles; terminal joint forming a very strong falciform claw. Caudal limbs in male natatory, basal lobe of inner branch usually transformed into two gill-like, more or less spirally twisted stems. Telson elongate, densely spinose at the edges, apex entire, not incised. Outer plate of uropoda broader than inner, and having an imperfect articulation at apex, outer edge partly spinous. Auditory apparatus well developed.

Remarks.—The present genus is chiefly characterised by the structure of the legs, which are more decidedly unguiculate than in any other known genus of Mysidans, further by the caudal limbs in the male having the basal expansion of the inner branch converted into peculiar gill-like appendages, finally by the structure of the telson and the outer plate of the uropoda. The genus is represented in most tracts of the ocean, and comprises about ten different species, the greater part of which would seem to lead a true pelagic existence, being met with at the surface of the sea, far from the coasts. The

Challenger specimens belong to two different species, to be described in the sequel. They may easily be known by the following distinctive characters :—

Eyes very large. Antennal scale linear. Telson exceedingly narrow, truncate at tip, ... *S. thompsoni* (M.-Edw.).

Eyes comparatively small. Antennal scale rhomboidal. Telson linguiform, with apex rounded, ... *S. gracilis*, Dana.

53. *Siriella thompsoni* (M. Edwards) (Pl. XXXVI. figs. 1–24).

Cynthia sp., V. Thompson, Researches, p. 55, pl. vi.
Cynthia thompsoni, M.-Edwards, Histoire nat. des Crustacés, t. ii. p. 462, pl. .
Siriella vitrea, Dana, United States Exploring Expedition, Crustacea, pt. i. p. 656, pl. xliii. figs. 6, *a–m*.
? *Siriella brevipes*, Dana, United States Exploring Expedition, Crustacea, pt. i. p. 660, pl. xliv. figs. 3, *a–b*.
Cynthia inermis, Kröyer, Nat. Hist. Tidsskr., 2den Række, Bd. i. p. 44, Tab. ii. figs. 6, *a–g* (male).
? *Promysis galatheæ*, Kröyer, Nat. Hist. Tidsskr., 2den Række, Bd. i. p. 59, Tab. ii. figs. 8, *a–k* (female).
Siriella edwardsii, Claus, Zeitschr. f. wiss. Zool., Bd. xviii. p. 271, pl. xviii.
Siriella thompsoni, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 50.

Specific Characters.—Form of body not very slender. Frontal projection acutely pointed. Last caudal segment shorter than the two preceding taken together. Eyes very large, with cornea greatly expanded. Antennal scale narrow, linear, apex somewhat obliquely truncate. Propodal joint of legs undivided, terminal claw of moderate length. Telson exceedingly narrow ; apex truncate, with three small teeth between the innermost pair of apical spines. Outer plate of uropoda much shorter than inner, with close upon six spines on the outer edge. Length attaining 10 mm.

Remarks.—I cannot but assume, that all the forms described under the different names referred to above, belong to one and the same species, and that this is the one first described by V. Thompson as *Cynthia* sp., and afterwards more fully designated by Milne-Edwards as *Cynthia thompsoni*. As the generic name *Cynthia* has been long since applied to a form of Ascidians, that proposed by Dana must of course be retained for the genus. Originally, the name *Cynthia* was only applied to the males, and *Siriella* to the females, the sexual differences being unknown till fully elucidated by Professor Claus.

Description.—The length of the largest example collected is about 10 mm., but most of the specimens in the collection are much inferior in size, though some of them are apparently adult.

The form of the body (see Pl. XXXVI. figs. 1–3) is comparatively less slender than in most of the other species, though not nearly so thickset, as represented in the figure given by Dana of his *Siriella vitrea*, which form in my opinion is identical with the present species.

The carapace is very small, not covering by far the whole of the trunk, two segments of which, and even a small part of a third, being exposed behind. It is evenly emarginate posteriorly in the middle, and tapers a little anteriorly, hence not being broader in its

anterior part than is the first caudal segment. The cervical impression is well marked, though not particularly deep. The frontal margin juts forth in the middle between the eyes as a narrow triangular lappet, sharply pointed at the tip, but not very prominent. The antero-lateral corners of the carapace are obtuse-angled, and but slightly produced.

The caudal segments are simple cylindrical and taper very slightly posteriorly, the anterior five about equal in length, whereas the last segment is somewhat more elongate.

The eyes are very large, pyriform, with the cornea considerably expanded, and occupying the greater part of the eye. The ocular pigment is of a dark black colour.

The antennular peduncle is rather slender, almost half as long as the carapace, and has the last joint in the female simple cylindrical, in the male (see fig. 4) slightly dilated, and about as long as the basal. The male appendage is rather large, but only slightly projecting in front of the peduncle, connate, as it is, with the lower face of the terminal joint to its very base (see fig. 5). On removing the numerous fine hairs, with which this appendage is clothed, the latter are found to originate from a narrow band doubled upon itself along the whole lower face of the appendage (fig. 5). Of the flagella, the outer is much more elongate than the inner, and provided along its proximal part with a row of delicate curved sensory bristles.

The antennal scale (fig. 6) does not quite reach the tip of the antennular peduncle, and exhibits a very narrow, linear form, about five times as long as broad. The outer edge is perfectly straight and naked, terminating with a small dentiform projection. The apex is somewhat obliquely truncate, with the inner corner slightly projecting. The flagellum does not attain the length of the outer antennular flagellum, and has the proximal part, or peduncle, shorter than the scale and very slender, with the middle joint by far the largest, and the last exceedingly small.

The anterior lip (see fig. 7) is produced anteriorly as a spiniform projection, similar to that occurring in the genus *Anchialus*.

The posterior lip does not exhibit any peculiarities in its structure.

The mandibles (see fig. 7) are of moderate size, with the armature of their cutting edges (fig. 9) perfectly agreeing with that in the other species of the genus, and rather differing from that in most other Mysidans. Thus, the molar protuberance forms merely a simple conical process, without any trace of the usual fluted surface. The palp (see fig. 7) has the middle joint considerably expanded and laminar, whereas the last joint (fig. 8) is comparatively narrow, with a dense row of ciliated bristles along the posterior half of the inner edge.

The first pair of maxillæ (fig. 10) exhibit quite a normal structure.

The second pair of maxillæ (fig. 11), on the other hand, are highly distinguished by the absolute want of the posterior masticatory lobe, only two such lobes being found. The palp is very fully developed, with the terminal joint rather large, oblong, and not incurved. The exognath is comparatively small and elliptical in form.

The maxillipeds (fig. 12) are more pediform than in most other Mysidans, the basal section being comparatively short, whereas the terminal part, or endopodite, is rather produced. The epipodite is comparatively small, and exhibits the usual lanceolate form and membranous structure.

The gnathopoda (fig. 13) are still more pediform, but rather smaller than the true legs, from which they moreover differ in the terminal joint being not unguiform but lamellar, and armed with numerous slender spines.

The true legs (figs. 14, 16) are comparatively less feeble in structure than in most other Mysidans, and more decidedly ambulatory in their character, the propodal joint being not multiarticulate and flexible, but quite rigid, and in the present species apparently undivided, whereas in the other species a short proximal articulation may be distinguished. From the tip of the propodal joint a double row of densely crowded and very delicate, finely serrate bristles are seen to spring, forming a dense fascicle, between which the terminal joint projects (see fig. 15). The latter has the form of a strong falciform claw, resembling that in the higher forms of Macrurans. The posterior pair of legs (fig. 16) are somewhat smaller and more slender than the rest, especially in the male, but do not differ in structure. In all the legs, and likewise in the maxillipeds and gnathopoda, the exopods are powerfully developed, with the basal part expanded and muscular, the terminal part consisting of about ten short setiferous articulations.

The marsupial pouch in the female is, as in the other species of the genus, composed of three pairs of incubatory lamellæ, of which, however, the anterior pair are very small.

The sexual appendages of the male (fig. 17) are comparatively small, and anteriorly have three strong ciliate setæ, the tip, moreover, being provided with a transverse row of short curved bristles.

The caudal limbs in the female (fig. 2) exhibit the rudimentary structure characteristic of the family. In the male (fig. 1), however, they are all strongly developed and natatory, with a broad muscular part, and multiarticulate setiferous branches, being moreover highly distinguished by the peculiar gill-like appendage originating at the base of the inner branch. This appendage, which undoubtedly corresponds to the simple lamellar expansion met with here in other male Mysidans, is divided into two cylindrical stems of a quite gill-like structure, and in the middle pairs (see figs. 19, 21) these stems are coiled up spirally, whereas in the first (figs. 18, 20) and last pair they are well-nigh straight. In the first pair, as usual, the terminal part of the inner branch is wholly wanting, this branch being exclusively represented by the above-mentioned appendage (see fig. 18). The fourth pair, which in male Mysidans generally exhibit some modification of the outer branch, would not seem to differ in any respect from the preceding pair.

The telson (fig. 22) is about as long as the two preceding segments taken together, and remarkably narrow, being considerably constricted in front of the middle, with the outer part almost linear and distinctly channelled along the dorsal face. The lateral

edges are armed in their outer part with numerous small denticles, and have moreover, near the base, on either side, three somewhat coarser denticles placed at some distance from the rest. The apex (fig. 23) is abruptly truncate, and bears six rather strong spines, the innermost pair the largest, and, between the latter, three very small denticles occur, besides two rather long and delicate setæ (omitted in the figure).

The uropoda (fig. 24) are rather large, projecting considerably beyond the telson. The inner plate is narrow lanceolate, with the auditory apparatus very fully developed, and the inner edge, beneath the marginal setæ, densely spinose. The outer plate is appreciably shorter than the inner, but rather broader, with the exterior edge armed, in front of the terminal linguiform articulation, with about six spines, increasing in size posteriorly.

As regards colour, the animal, according to Dana, is in a living state almost colourless, though sometimes purply along the ventral face of the tail, and tinged with red at the sides of the anterior division (the marsupial pouch). This purplish and reddish colour is found to arise from stellate pigmentary deposits distributed with great regularity and still retained in the specimens preserved in spirit. Thus, along the ventral face of the tail is seen (figs. 1, 2, 3) on each segment a median and two lateral pigment-spots, the one occurring at the end of the last segment being considerably ramified. On the two posterior exposed segments of the trunk, similar pigment-spots may be seen, and on either side of the marsupial pouch in the female (fig. 2), an exceedingly ramified reddish pigmentary deposit may with facility be discerned. Moreover, at the inner side of the antennular peduncle, similar pigmentary ramifications occur, extending to a greater or less distance even into the inner flagellum.

Habitat.—All the specimens in the collection were taken at the surface of the sea. The following is a list of the localities, with dates appended :—

Date.	Locality.
?	Between Tenerife and St. Thomas.
June 18 to 19, 1873.	North Atlantic.
October 5, 1873.	South Atlantic.
June 17, 1874.	Australian Seas, Sydney to Wellington.
April 3, 1875.	North Pacific.
July 23, 1875.	North Pacific.
August to September 1875.	Pacific Ocean.
October 18, 1875.	South Pacific.
October 19, 1875.	South Pacific.
October 22, 1875.	South Pacific.
November 17, 1875.	South Pacific, off coast of Chili.
March 3 to 5, 1876.	South Atlantic.
March 14, 1876.	South Atlantic.
April 26, 1876.	North Atlantic, off Cape Verde.
April 29, 1876.	North Atlantic.

The specimen examined by V. Thompson, and also those described by Milne-Edwards and Kröyer, were from the Atlantic. Dana collected the species (=*Siriella vitrea* and *Siriella brevipes*) in the Pacific. The specimens examined by Professor Claus were derived from the Museum in Hamburg; locality not recorded.

Distribution.—According to the localities stated above, the present species would seem to have a very extensive geographical distribution, ranging, as it does, throughout the North and South Atlantic, the Australian Seas, and the Pacific Ocean.

54. *Siriella gracilis*, Dana (Pl. XXXVI. figs. 25–28).

Siriella gracilis, Dana, United States Exploring Expedition, Crustacea, i. p. 658, pl. xliv. figs. 1, *a–g*.
Siriella gracilis, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 51.

Specific Characters.—Form of body somewhat more slender than in *Siriella thompsoni*. Frontal plate triangular, less acute. Last caudal segment as long as the two preceding taken together. Eyes much smaller than in preceding species, cornea scarcely expanded at all, and occupying but a small part of the eye. Antennal scale rhomboidal, apex very obliquely truncate, inner corner projecting. Propodal joint of legs distinctly subdivided into two articulations, terminal claw very elongate. Telson linguiform, apex evenly rounded, with a small tridentate plate issuing between the last pair of elongate spines. Uropoda with outer plate but slightly shorter than inner, and having a smaller number of spines at the exterior edge. Length about 6 mm.

Remarks.—The present species may be easily distinguished from the preceding by a somewhat more slender form of body, the less developed eyes, and the deviating form of the antennal scale and of the telson.

Description.—The length of the largest specimen in the collection does not exceed 6 mm., and this species is hence of rather smaller size than the preceding.

The form of the body (see Pl. XXXVI. fig. 25) appears somewhat more slender than in *Siriella thompsoni*, though not nearly to such a degree as in certain other species of the genus.

The carapace exhibits a form very similar to that in *Siriella thompsoni*, but has the frontal projection somewhat less pointed and triangular in form.

Of the caudal segments, the last is rather elongate, about as long as the two preceding segments taken together.

The eyes are far from so fully developed as in *Siriella thompsoni*, being but very slightly expanded at the end, with the cornea occupying a comparatively small part of the eye.

The antennular peduncle would seem to have the last joint relatively shorter than in the preceding species, but for the rest it exhibits a very similar structure.

The antennal scale (fig. 26), on the other hand, is very different, being comparatively

shorter and broader, only three times as long as broad, and of a somewhat rhomboidal form, the apex being very obliquely truncate, with the inner corner strongly projecting, and the denticle of the outer farther removed from the apex than is the case in *Siriella thompsoni*.

The legs are somewhat more robust, and have the propodal joint distinctly subdivided into two articulations, the proximal being the shorter. The terminal claw, moreover, is comparatively much more elongate.

The telson (see fig. 27) is somewhat less slender than in the preceding species, and has a decidedly linguiform shape, the apex being evenly rounded, not truncate. The lateral edges are coarsely denticulate along their outer part, and the posterior pair of denticles, issuing from the apex, are considerably longer than the rest. Between the latter projects (see fig. 28) a small tridentate plate bearing two delicate diverging bristles.

The uropoda (see fig. 27) have the inner plate but very slightly longer than the outer, and the auditory apparatus well developed. The outer plate has a smaller number of spines at the exterior edge than in *Siriella thompsoni*, not more than two or three being frequently found.

The arrangement of the pigmentary spots on the body is very similar to that in the preceding species. But in this form occurs in addition a richly arborescent pigmentary deposit on the basal part of the telson, as also on the ocular pedicles.

Habitat.—Of this species, too, all the specimens in the collection were taken at the surface of the sea, but somewhat sparingly, not more than one or two specimens being taken as a rule in each place. The following is a list of the localities, with dates appended :—

Date.	Locality.
September 13, 1874.	Arafura Sea.
February 5, 1875.	Off Samboangan, Mindanao, Philippine Islands.
February 1875.	North of New Guinea.
April 3, 1875.	North Pacific.
August 24, 1875.	Tropical Pacific.
August to September 1875.	Tropical Pacific.

The specimens examined by Dana were collected in the Pacific at three different localities.

Distribution.—To judge from the above stated localities, the distribution of the present species would seem to be more restricted than is that of the preceding form, it being exclusively met with in the Pacific Ocean and the seas of the Indian Archipelago.

Genus 8. *Euchætomera*, G. O. Sars, 1883.

Euchætomera, G. O. Sars, Preliminary Notices on the Challenger Schizopoda.

Generic Characters.—Carapace not fully covering trunk, emarginate posteriorly; frontal margin slightly projecting in the middle. Eyes somewhat irregular in form, cornea contracted in the middle. Antennular peduncle of moderate size; male appendage normally developed. Antennal scale with outer edge naked and terminating in a dentiform projection, apex obliquely truncate, with inner corner projecting. Legs very slender, increasing in length posteriorly, and provided with unusually strong plumose setæ, propodal joint subdivided into three distinctly defined and mobile articulations, terminal joint unguiform, exopods with terminal part very elongate and flexible. Caudal limbs in female simple but rather large, laterally extended and fringed with remarkably strong setæ; those of male all natatory. Telson remarkably short, lamelliform, rounded, apex entire and provided with two long ciliated setæ. Uropoda with elongate and narrow plates, fringed all round with long setæ, inner plate much shorter than outer, and with auditory apparatus well developed.

Remarks.—The present new genus is chiefly characterised by the unusually short, lamelliform telson, agreeing somewhat in form with that of the genus *Erythrops*, G. O. Sars; also by the slender legs and the very strong development of the setæ on the several limbs. The species of this genus would seem to lead a pelagic existence as is the case with those of the preceding genus, met with, as they are, at the surface of the sea far from the coasts. Two species are represented in the collection, easily distinguished by the armature of the telson, as follows:—

Telson { with lateral edges denticulate, ... *E. typica*, G. O. Sars.
{ without lateral denticles, ... *E. tenuis*, G. O. Sars.

55. *Euchætomera typica*, G. O. Sars (Pl. XXXVII. figs. 1–20).

Euchætomera typica, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 52.

Specific Characters.—Form of body rather robust. Carapace broadly emarginate posteriorly, exposing almost wholly the two last segments of the trunk; frontal projection acutely pointed. Last caudal segment comparatively short. Eyes of moderate size, pyriform, projecting on either side, and separated at the base by a distinct interval. Antennal scale oblong, somewhat curved, about four times as long as broad, spine of outer corner remarkably strong. Telson fully as broad as long, with five strong lateral denticles on either side. Length, 14 mm.

Remarks.—The examination of this and the following form, as regards external appearance, has been somewhat difficult, from the specimens being mounted on glass

slides in shallow cells, whereby the body has been partially crushed and deformed. The anatomical details have, however, been satisfactorily made out from the dissection of one of the specimens.

Description.—The length of the adult female is about 14 mm., that of the male nearly the same.

The form of the body (see Pl. XXXVII. fig. 1) would appear to be rather short and robust, with the tail relatively less elongate than usual, in proportion to the anterior division.

The carapace does not nearly cover the whole of the trunk, the two posterior segments of which are well nigh entirely exposed. It is evenly emarginate posteriorly, and exhibits in its anterior part a distinct, though not particularly deep, cervical impression. The frontal margin juts out in the middle as a narrow acuminate lappet, projecting between the bases of the eyes and reaching to about the middle of the basal joint of the antennulæ.

The tail does not exceed in length the anterior division of the body, and has the segments rather thick in proportion to their length. The last segment only slightly exceeds the preceding in length.

The eyes—separated at the base by a distinct interval—are of moderate size, and extend to each side so as to project considerably laterally. They are pyriform in shape, about as long as broad, with the cornea rather expanded, and exhibiting in the middle a similar constriction to that seen in the species of the Euphausiidan genera, *Thysanoëssa*, *Nematoscelis*, and *Stylocheiron*.

The antennular peduncle (fig. 2) presents quite a normal appearance, being somewhat dilated towards the apex, with the last joint about as long as the basal, and having three strong ciliated setæ springing from the inner edge. In the male, a hairy lobe projects, as usual, from the end of the peduncle beneath the insertion of the flagella. The latter were both broken off near their base in the specimens examined.

The antennal scale (fig. 3) only slightly exceeds in length the antennular peduncle, and exhibits an oblong-linear form, about four times as long as broad. It is somewhat curved outwards, and has the exterior edge naked and slightly concave, jutting out at the end as a very strong dentiform projection. The apex is obliquely truncate, having the inner corner projecting and fringed, together with the whole inner edge, with about seventeen unusually strong and densely ciliate setæ. The proximal part of the flagellum does not attain the length of the scales, and has the middle joint longest, with three plumose setæ at the end interiorly.

The anterior lip (fig. 4) exhibits the usual somewhat galeate form, with an obtusely rounded prominence anteriorly.

The posterior lip (fig. 5) has the terminal lobes obliquely rounded and densely ciliate, with a slight angle exteriorly.

The mandibles (fig. 6) are powerfully developed, with the masticatory part considerably expanded, and the cutting edges (fig. 7) exhibiting an armature similar to that observed in most other Mysidans. The palp (see fig. 6) is longer than the mandible itself, and has the middle joint largest, with a row of strong plumose setæ along its outer edge. Its terminal joint is lamelliform, and, besides a number of elongate setæ, furnished near the tip with a row of small spinules.

The first pair of maxillæ (fig. 8) exhibit quite a normal appearance.

The second pair of maxillæ (fig. 9) have the terminal joint of the palp rather large and sharply incurved, oval in form, and furnished along the outer edge with seven exceedingly elongate setæ, the outer part of which is somewhat curved and quite naked, whereas their proximal part is coarsely ciliate. The exognath is comparatively small and triangular in form, with about nine marginal setæ.

The maxillipeds (fig. 10) are rather strong, with the basal part jutting out at the end interiorly as a small linguiform masticatory lobe. The joints of the endopodite are comparatively broad and appressed, the last triangular, with a strong apical spine. The exopodite is much longer than the endopodite, but very slender, with the basal part rather narrow and the terminal part composed of ten articulations. The epipodite, finally, is unusually small and oval in form, with four bristles springing from its upper face.

The gnathopoda (fig. 11) are, as usual, more pediform in character, though differing considerably in appearance from the true legs. The endopod is rather elongate, with the carpal and propodal joints largest and nearly equal in length, as also very movably jointed together. The terminal joint is very small and densely hirsute; it is sharply incurved and exceedingly mobile, admitting of being bent in against the preceding joint.

The legs (fig. 12) are very slender and elongate, increasing somewhat in length posteriorly, and are furnished, too, with unusually strong plumose setæ. The terminal part is somewhat longer than the preceding (carpal) joint, and subdivided into three distinctly defined and mobile articulations, besides the apical claw (fig. 13), which is well developed, though not particularly strong. Of the propodal articulations, the first is by far the largest, in the anterior pair (fig. 12) about as long as the other two taken together, in the posterior pair (fig. 14) still longer and much narrower.

The marsupial pouch in the female would seem to agree in structure with that of *Mysis*.

The caudal limbs in the female (figs. 15, 16) constitute, as usual, simple, non-articulate narrow plates, but are somewhat larger and more projected laterally than in most other Mysidans. Moreover, their marginal setæ are remarkably strong, and exhibit a very peculiar ciliation, the cilia being disposed in dense verticils at regular intervals (see fig. 17). In the male all the limbs are natatory, with multiarticulate setiferous branches. In the first pair (fig. 18) the inner branch is, as usual, rudimentary and non-articulate, and would seem to lack the basal expansion.

The telson (fig. 20) exhibits an aspect most characteristic of the genus and quite different from that usually met with in the Mysidæ, save in the genus *Erythrops*, G. O. Sars. It is very short, lamelliform, fully as broad at the base as it is long, having the lateral edges armed on either side with five strong denticles, and the apex narrowly truncate, bearing in the middle two very long and densely ciliate setæ.

The uropoda (fig. 19) have the terminal plates very slender and fringed all round with strong plumose setæ. The inner plate is much the shorter and lanceolate in form, with the base considerably dilated and containing a fully developed auditory apparatus, the otolith being rather large and of globular form. The outer plate is about one-fifth longer than the inner, and very narrow, linear, though somewhat curved outwards and truncate at the tip.

As to colour, the specimens preserved in glycerine were of a uniform light brownish hue, without any trace of the stellate pigmentary spots found in the species of the preceding genus.

Habitat.—Of this form only three specimens were found in the collection, taken at the surface of the sea in the North Pacific. The following is a list of the localities, with dates appended:—

Date.	Locality.
June 28, 1875.	Station 244; lat. 35° 22′ N., long. 169° 53′ E.
July 2, 1875.	Station 246; lat. 36° 10′ N., long. 178° 0′ E.
July 12, 1875.	Station 252; lat. 37° 52′ N., long. 160° 17′ W.

Quite recently I have had an opportunity, through the kindness of Mr. Hoyle, of examining another specimen, a young female, of apparently the same species, taken April 9, 1876, in the Atlantic. The specimen was mounted on a glass slide together with a small Cephalopod and several other surface animals.

56. *Euchætomera tenuis*, G. O. Sars (Pl. XXXVII. figs. 21–24).

Euchætomera tenuis, G. O. Sars, Preliminary Notices on the Challenger Schizopoda, No. 53.

Specific Characters.—Form of body more slender than in preceding species, tail especially much narrower, with last segment greatly elongate. Carapace comparatively large, posterior emargination rather narrow, rostral projection very slight. Eyes greatly expanded, broader than long, and close together. Antennal scale very narrow, six times as long as broad, denticle of outer corner small. Legs exceedingly slender, with scattered but rather long bristles. Telson having lateral edges perfectly smooth, apex with a slight dentiform projection on either side. Length, 8 mm.

Remarks.—The present species may be easily known from the preceding by its exceedingly narrow tail, the last segment of which is greatly elongate, by the short and thick eyes, the narrow antennal scale, and the want of lateral denticles on the telson.

Description.—Only a single specimen, apparently a young female, was procured during the Expedition. It has a length of 8 mm.

The form of the body (see Pl. XXXVII. fig. 21), somewhat deformed in the specimen by pressure, would appear to be much more slender than in *Euchætomera typica*, and the tail in particular is remarkably narrow, as compared with the anterior division.

The carapace would seem to be relatively larger than in the preceding species, its wings partly advancing over the first caudal segment. It exhibits, however, posteriorly in the middle, a deep but narrow emargination, exposing the dorsal part of the two posterior segments of the trunk. The frontal margin presents in the middle a very slight projection, scarcely reaching beyond the ocular segment.

The caudal segments are cylindrical, and the four anterior very short and subequal, the fifth a trifle longer, and the last exceedingly elongate, nearly as long as the preceding three taken together.

The eyes are greatly expanded toward the apex, being broader than long, and originate close together, so as not to project laterally. The cornea exhibits, somewhat anterior to the middle, a transverse constriction similar to that in the preceding species.

The antennular peduncle appears somewhat more slender than in *Euchætomera typica*, but otherwise exhibits a very similar structure.

The antennal scale (fig. 22) is very narrow, linear, about six times as long as broad, and very slightly curved. As in the preceding species, the apex is obliquely truncate, with the inner corner somewhat projecting and the outer armed with a dentiform projection, but the latter is far from so strong as in that species.

The legs (fig. 23) are extremely slender, and the posterior pair reach, when reflexed, even beyond the last caudal segment (see fig. 21). In their structure they agree with those in the preceding species, saving that the marginal setæ are fewer in number and also rather more elongate.

The telson (fig. 24) exhibits a short lamelliform shape similar to that of *Euchætomera typica*, being but very little longer than broad, but differs materially in the lateral edges being perfectly smooth, without a trace of the strong denticles occurring in that species. The apex is narrowly truncate, with a very small dentiform projection on either side, and the terminal setæ placed close together.

The uropoda do not seem to differ essentially from those in *Euchætomera typica*, saving that their terminal plates are a trifle more slender.

Habitat.—The above described specimen was taken November 18, 1875, at the surface of the sea, in the South Pacific, off the coast of Chili.

Genus 9. *Heteromysis*, Smith, 1874.

Heteromysis, Smith, Report upon the Invertebrate Animals of Vineyard Sound and adjacent waters.
Chiromysis, G. O. Sars, Middelhavets Mysider.

Generic Characters.—Form of body comparatively short. Carapace emarginate posteriorly, not covering completely the trunk, frontal margin projecting in the middle. Eyes small. Antennal scale very minute, lamelliform, setose on both edges. First pair of true legs much stronger than the rest, with propodal joint entire and spinous at inner edge; terminal joint unguiform. Remaining legs feeble in structure, with terminal part multiarticulate and setous, terminal claw obsolete. Caudal limbs in both sexes of same structure, forming small, simple, non-articulate, setose plates. Telson comparatively short, deeply cleft at apex. Inner plate of uropoda shorter than outer.

Remarks.—This genus, first established by Professor Smith, is most prominently characterised by the peculiar and strong development of the first pair of true legs, as also by the caudal limbs in the male being of the same rudimentary appearance as in the female. Three species of this genus have hitherto been recorded, viz., *Heteromysis formosa*, Smith, from the eastern coast of North America, *Heteromysis microps*, G. O. Sars, from the Mediterranean, and *Heteromysis norvegica*, G. O. Sars, from the Norwegian coast. A fourth species, to be described below, was also taken on the Challenger Expedition. All the species are decidedly littoral in character, being never met with either in the open sea, or at any considerable depth.

57. *Heteromysis bermudensis*, n. sp. (Pl. XXXVIII. figs. 1–7).

Specific Characters.—Form of body exceedingly short and thickset. Carapace evenly arched above, frontal projection triangular. Last caudal segment not longer than preceding. Eyes ovoid, cornea occupying about a third part of the eye, ocular pigment dark. Antennal scale oblong-oval, about three times as long as broad. Telson triangular, lateral edges armed on either side in their outer part with about six denticles; apical incision occupying third part of length of telson, somewhat broad, only inner half bordered with spinules; terminal lobes narrow, with two unequal apical spines. Length, 6 mm.

Remarks.—This species would seem to be most nearly related to the Norwegian form, *Heteromysis norvegica*, G. O. Sars, from which, however, it may be readily distinguished by its much inferior size and more thickset form. It also exhibits great resemblance to *Heteromysis formosa*, Smith, but differs in the small size of the antennal scale and the somewhat deviating form and armature of the telson. From the Mediterranean form, *Heteromysis microps*, G. O. Sars, it is likewise distinguished by the form and armature of the telson, as also by its more fully developed eyes.

Description.—Only a solitary, somewhat mutilated specimen, an adult female, was procured on the Expedition. It measures only 6 mm. in length.

The form of the body (see Pl. XXXVIII. figs. 1, 2) is remarkably short and thick-set, more so than in any of the previously known species, with the anterior division somewhat dilated.

The carapace is evenly arched above and deeply emarginate posteriorly, exposing the dorsal part of the two last segments of the trunk. It has a distinct, though not very sharply marked cervical sulcus, and its inferior margins are evenly incurved in the middle. The frontal margin projects in the middle almost at a right angle, covering a part of the ocular pedicles, and the antero-lateral corners are but slightly produced as rather broad, obtuse-angled lobes.

The caudal segments are all well-nigh of equal length and a little depressed, their breadth being somewhat greater than their height.

The eyes are comparatively small, of a regular ovoid form, and projecting but slightly at the sides. The cornea occupies about one-third of the eye, and has a dark pigment.

The antennular peduncle (fig. 3) is rather short and thick, with the last joint as large as the basal, and the middle joint very obliquely truncate at the end.

The antennal scale (fig. 4) is exceedingly small, scarcely as long as the antennular peduncle, and of an oblong-oval form, about three times as long as broad. It is fringed all round with long setæ (omitted in the figure), and has a very short terminal articulation.

The oral parts could not, of course, be examined closely in the sole specimen before us.

All the legs were broken off, their basal parts only being left.

The marsupial pouch (see fig. 1) was fully developed in the specimen, and contained young, in the so-called pupa stage (figs. 6, 7), agreeing perfectly with those of other Mysidans.

The telson (fig. 5) is of a somewhat triangular form, broadest at the base, and regularly tapering toward the apex. The lateral borders are in greater part quite smooth, armed in their hinder part only, on either side, with about six denticles. The apical incision is very deep, occupying, as it does, fully one-third of the length of the telson, and also rather broad. The edges limiting the incision are quite smooth in their hinder half, whereas a dense fringe of spinules runs along the anterior part, much as in the Norwegian species. The terminal lobes are rather narrow, and bear on the tip two somewhat unequal spines, the outer being the longer.

The uropoda (see fig. 2) do not exhibit any essential difference from those in the other species, their terminal plates being comparatively broad, and the inner plate much shorter than the outer, with the auditory apparatus distinctly developed.

Habitat.—The above-described specimen I took from a small bottle containing specimens of *Paranebalia longipes* (Willemoes-Suhm), collected in shallow water at the Bermuda Islands.

APPENDIX.

NOTES ON SOME PARASITES OBTAINED FROM THE CHALLENGER SPECIMENS OF SCHIZOPODA (Pl. XXXVIII. Figs. 8–23).

In the following pages I purpose directing the attention of zoologists to certain ecto- and endo-parasites found infesting a few of the Challenger Schizopoda I have examined. My intention is not to give full descriptions of these parasites, belonging, as they do, to groups on which I have not been called upon to report. Meanwhile, I have not seen fit to pass them by altogether, seeming, as they do, to exhibit quite a particular interest, and, moreover, since they undoubtedly may serve to complete our knowledge of the biology of the Schizopoda.

Long ago Kröyer recorded[1] a peculiar Bopyridan infesting the Arctic Mysidan, *Mysis oculata*, Fabr., under the name of *Dajus mysidis*, which form has more recently been described by Buchholtz[2] and Hoek[3] under a new generic name, viz., *Leptophryxus*, the latter authors having apparently not been aware of the figures and name given by Kröyer in the above cited work. This form was the only known parasite found on Schizopods, until the author recorded[4] three other Bopyridans, likewise met with on certain Schizopods (*Eurythrops*, *Amblyops*, and *Pseudomma*). These three Bopyridans were found to belong to two distinct genera, viz., *Aspidophryxus*, G. O. Sars, and *Notophryxus*, G. O. Sars. Moreover, the author has observed, on species of the Mysidan genus *Erythrops*, a peculiar Lernæid, apparently the *Sphæronella leuckartii* of Salensky. All these forms are, however, true ecto-parasites. No endo-parasites, on the other hand, have as yet been found in any form of Schizopods. But in a few specimens of Euphausiidans from the Challenger Expedition, I have also succeeded in detecting two forms of true endo-parasites, or intestinal worms, one of which, at least, exhibits a most peculiar appearance and certain highly remarkable features. On Pl. XXXVIII. I have given figures of all the parasites met with, for the most part in their natural position on the Schizopods infested by them.

[1] Gaimard's Voyage en Scandinavie, Zoologie.

[2] Die zweite deutsche Polarfahrt., Zoologie.

[3] Die Crustaceen gesammelt während der Fahrten des "Willem Barents" in den Jahren 1878 und 1879.

[4] Oversigt over Norges Crustaceer, i.; and, Crustacea et Pycnogonida nova Expeditionis Norvegicæ.

Ecto-Parasites (Pl. XXXVIII. figs. 8–14).

All these forms belong to the Bopyridan tribe and the family Dajidæ, and occur attached in different parts of the anterior division of the body on certain Schizopoda from the Challenger Expedition. As usual, the dwarfed males are found adhering to the posterior part of the body of the much larger females.

The form represented in fig. 8 exhibits at the first glance, both as regards its external appearance and relative position to the body of the Schizopod, to which it is attached, a striking resemblance to the Norwegian form *Aspidophryxus peltatus*, G. O. Sars. Nevertheless, it cannot properly be referred even to the same genus, since the clasping legs are not, as in that genus, crowded together anteriorly at the sides of a very restricted median area, but are found arranged along the lateral edges of the body, the four anterior pairs occurring at the sides of the anterior half, whereas the posterior pair originate far behind the rest, near the posterior extremity of the body. This posterior pair of legs would seem, moreover, to exhibit a very peculiar structure, having the aspect of two rather large posteriorly directed appendages, bifurcate at the extremity. The body is distinctly segmented along the median part, and mottled there with densely crowded pigment spots, whereas the greatly expanded and vaulted lateral parts are quite smooth and pellucid, admitting of the ovaries, with their numerous ova, to be distinctly traced through their walls. The male (see fig. 8, *b*) is seen adhering to the posterior end of the body of the female, or the rudimentary tail, and would seem to agree in structure with that of *Aspidophryxus*. The above recorded parasite was found on a specimen of *Euphausia pellucida*, Dana, taken off Cape Verde Islands, April 26, 1876, and was mounted, together with the Schizopod itself, in Canada balsam on a glass slide. It may properly be named *Heterophryxus appendiculatus*, n. gen. et sp.

The two forms represented in figs. 9, 10, 11 would seem, as regards their general structure, to agree tolerably well with the species of the genus *Notophryxus*, G. O. Sars, the body being sac-like, with but very slightly indicated segmentation, and with the five pairs of clasping legs crowded together in the anterior part of the ventral face, at the sides of the oral area (see fig. 10). One of the forms (figs. 9, 10) has, however, a rather anomalous position on the Schizopod, not being, as usual, attached to the dorsal face but to one of the sides of the body, or, more precisely, to the base of the penultimate gill, for which reason it may properly be named *Notophryxus lateralis*, n. sp. It was found on two specimens of *Nematoscelis megalops*, G. O. Sars, taken in the South Atlantic, March 9, 1876. The other form (fig. 11) was found attached to the posterior part of the dorsal face of the carapace on a specimen of *Thysanoëssa gregaria*, G. O. Sars, taken July 10, 1875, in the North Pacific. Owing to its comparatively short and thick-set body, this form may be termed *Notophryxus globularis*, n. sp.

The fourth form, finally (figs. 12, 13, 14), evidently belongs to the genus *Dajus*,

Kröyer, though unquestionably distinct from the Arctic form *Dajus mysidis*, Kröyer. The adult female (figs. 12, 13) has, in its external appearance, a very striking similarity to certain parasitic Copepoda, the anterior division of the body being greatly expanded and of a rounded triangular form, with a slightly indicated segmentation, whereas the posterior part, or tail, is abruptly narrowed, more distinctly segmented, and terminates in two simple lamelliform appendages, reminding one of the so-called furca of the Copepoda. The five pairs of clasping legs are (see fig. 13) crowded together on either side of the buccal area, which occupies about the centre of the ventral face of the anterior division. The male (figs. 12, 13, *a*, 14) differs, as in the typical species, materially from the males of the preceding forms, in having the tail distinctly segmented and furnished with well-developed pleopoda, as also with a pair of biramous uropoda. It is found with its anterior part deeply immersed in a hollow space of the female, lying ventrally at the end of the anterior division, and partly defined by two wing-like, posteriorly pointing cuticular folds (see fig. 13), the remaining part of its body projecting freely behind in the same axis as that of the female. Both the female and the male, but more especially the latter, are variegated with dark pigment deposits over their dorsal face. This peculiar form was found attached to the ventral face of the trunk posteriorly on a few specimens of *Siriella thompsoni* (Milne-Edwards), both males and females, in the latter lying partly within the marsupial pouch, as was also the case with *Dajus mysidis*. It may justly be named *Dajus siriellæ*, n. sp.

Endo-Parasites (Pl. XXXVIII. figs. 15–23).

The two forms of parasites treated on under this head were both found within the body cavity of certain Euphausiidæ, their bodies freely suspended in the perivisceral fluid of the Schizopods, and not covered by any particular envelope or cyst. They evidently belong to two different groups of intestinal worms, the one being an Acanthocephalan, the other a Trematode. Concerning both, I have thought it right to consult the celebrated German Professor Rudolf Leuckart, unquestionably the greatest authority as regards intestinal worms, and he has most cordially given me his suggestions respecting the present interesting forms. None of them can, according to Professor Leuckart, be regarded as sexually mature, but represent a mere transitory stage, that probably does not arrive at full maturity, before being transferred into the intestinal canal of some higher animals, most likely fishes or whales, which are both known to feed largely upon Euphausiidæ. In their present stage of development they simply absorb through the skin the perivisceral fluid, in which their bodies are suspended, and are thus placed under particularly favourable conditions of life, whence their comparatively large size, in proportion to the size of the Schizopods infested by them.

The form represented in figs. 15–18 is readily recognised as a species of the genus

Echinorhynchus, Müller, more especially by the cylindrical proboscis (see fig. 17), protruding from the ventral face of the anterior extremity, and armed with numerous strongly chitinised recurved hooks (fig. 18). The body (see fig. 16) is rather elongate and somewhat flattened, irregularly wrinkled transversely, and obtusely rounded at both ends. It was found within the body cavity of a specimen of *Euphausia pellucida*, Dana, occupying the greater part of its length, and bent, moreover, in the form of the letter S (fig. 15). The species may, on account of its irregularly wrinkled body, be properly named *Echinorhynchus corrugatus*, n. sp.

The other form (figs. 19–23) exhibits a very peculiar appearance, but may nevertheless be undoubtedly determined as a species of the genus *Distomum*, Zed., since it presents two well-defined sucking disks, the one anterior, or oral, the other ventral. The body is not, as usual, flattened, but cylindrical and twisted in a peculiar manner, having, moreover, the ventral sucking disk mounted at the end of a cylindrical peduncle that stands out at right angles from the body. The integument is rather firm and muscular, as also densely wrinkled transversely throughout its anterior half, but rather pellucid, so as to admit of the two spirally twisted intestinal cæca being distinctly traced within the body. The most peculiar feature of this form is, however, the mode in which it is affixed within the body cavity of the Schizopod. For this is not effected by any of the sucking disks, but with the aid of a kind of byssus excreted from the posterior end of the animal and dispersed within a peculiar sac-like body, lying transversely within the posterior part of the body cavity of the Schizopod (see fig. 19), and at least with one of its extremities firmly connected with the outer skin, thus often producing a conspicuous mamilliform projection behind the posterior gill (see Pl. XXIII. fig. 10). Whether this peculiar body ought to be referred to the parasite itself, or possibly should be regarded as a pathological product of the Schizopod, is still uncertain. On opening the body just mentioned, the byssus is found to consist of two rather strong filaments (see figs. 21, 22), more or less twisted upon themselves, as a rope, and of a number of very fine and highly adhesive fibres (fig. 23), partly curled up in globular masses, and partly stretching along the two filaments. The slightest touching of the byssus with any object will cause such objects to adhere rather firmly thereto, even in spirit-specimens. This very peculiar intestinal worm I found in several specimens of the two Euphausiidans, *Nematoscelis megalops*, G. O. Sars, and *Thysanoëssa gregaria*, G. O. Sars, from the South Atlantic, invariably affixed within the body cavity of the Schizopod in the same peculiar manner, the body itself with its sucking disks being freely suspended anteriorly within the perivisceral fluid, and, as a rule, a little asymmetrically, towards the right or left side of the intestinal canal of the Schizopod. Professor Leuckart has proposed to designate the species *Distomum filiferum*, n. sp., and will give a short account of its structure in an Appendix to one of the forthcoming Zoological Reports.

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PLATE I.

PLATE I.

Figs. 1–7. *Lophogaster typicus*, M. Sars.

Fig. 1. Adult male, from left side ; magnified about five times.

Fig. 2. Female, from above.

Fig. 3. Anterior part of carapace of male, along with eyes, antennulæ and antennæ, viewed from above.

Fig. 4. Basal part of a female antenna, with antennal scale and proximal section of flagellum, from below.

Fig. 5. Leg of last pair.

Fig. 6. Posterior extremity of tail, with caudal fan, from above.

Fig. 7. Extremity of telson ; more highly magnified.

Figs. 8–17. *Ceratolepis hamata*, G. O. Sars.

Fig. 8. Female, from left side ; magnified about ten times.

Fig. 9. Same, from above.

Fig. 10. Anterior part of carapace, with eyes, from above ; somewhat more magnified.

Fig. 11. Anterior part of body, viewed from the ventral face, showing antennulæ (a'), antennæ (a^2), antennal scale (sq), anterior lip (L), mandibles (M), mandibular palps (p), second pair of maxillæ (m^2), maxillipeds (mp'), with their rudimentary exopodite (x).

Fig. 12. Base of an antenna, with antennal scale.

Fig. 13. One of the gnathopods.

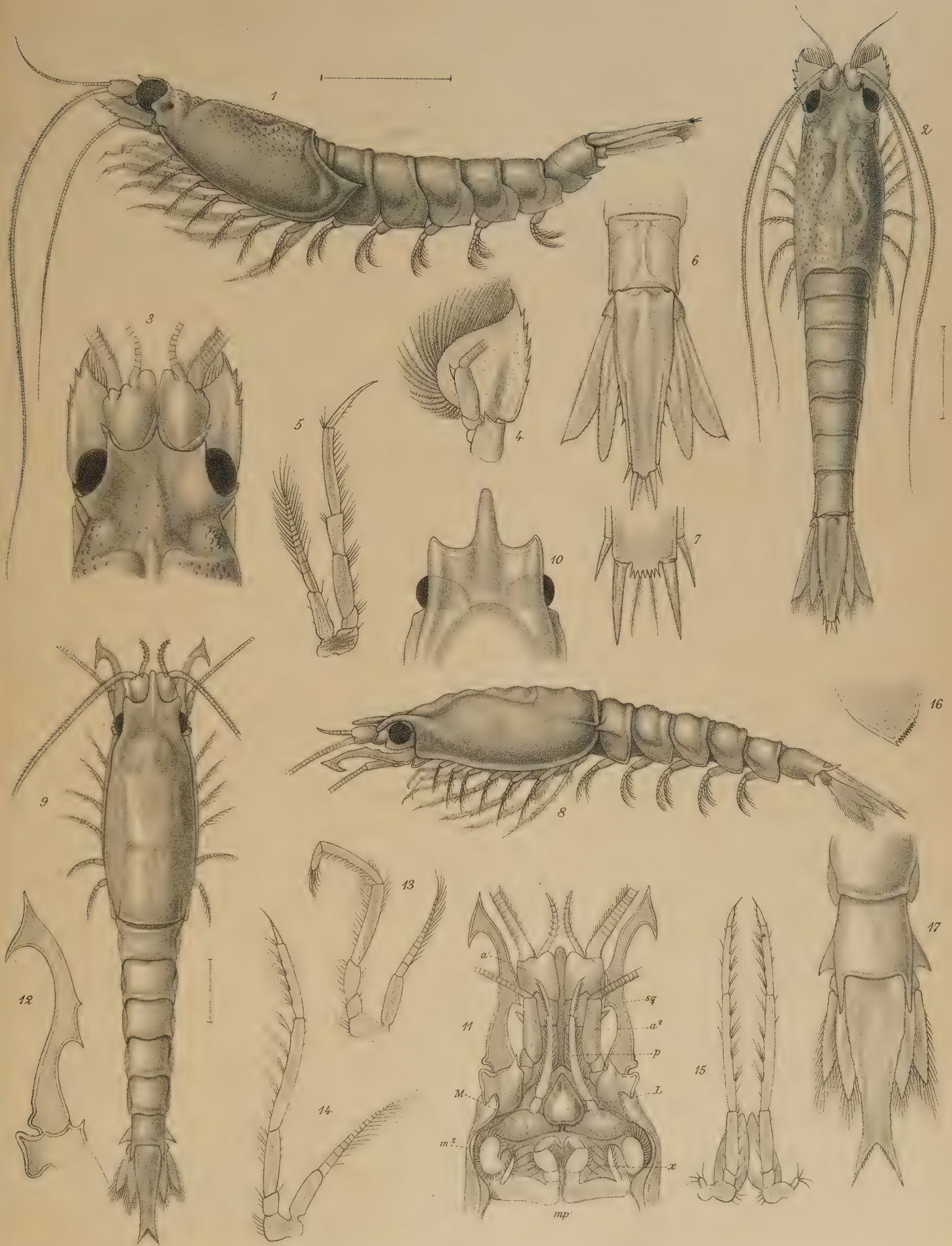
Fig. 14. One of the legs.

Fig. 15. Posterior pair of legs, with the corresponding pair of incubatory lamellæ and the rudimentary exopods.

Fig. 16. A caudal epimeron, lateral aspect.

Fig. 17. Extremity of tail, with caudal fan, from above.

Note.—The figures on all the plates have been drawn by the author with the aid of the camera lucida.



Figs. 1–7, LOPHOGASTER TYPICUS, M. Sars.
„ 8–17, CERATOLEPIS HAMATA, n. gen. & sp.

PLATE II.

PLATE II.

Gnathophausia ingens (Dohrn).

Fig. 1. Adult female, from right side; natural size.

Fig. 2. Same, from above.

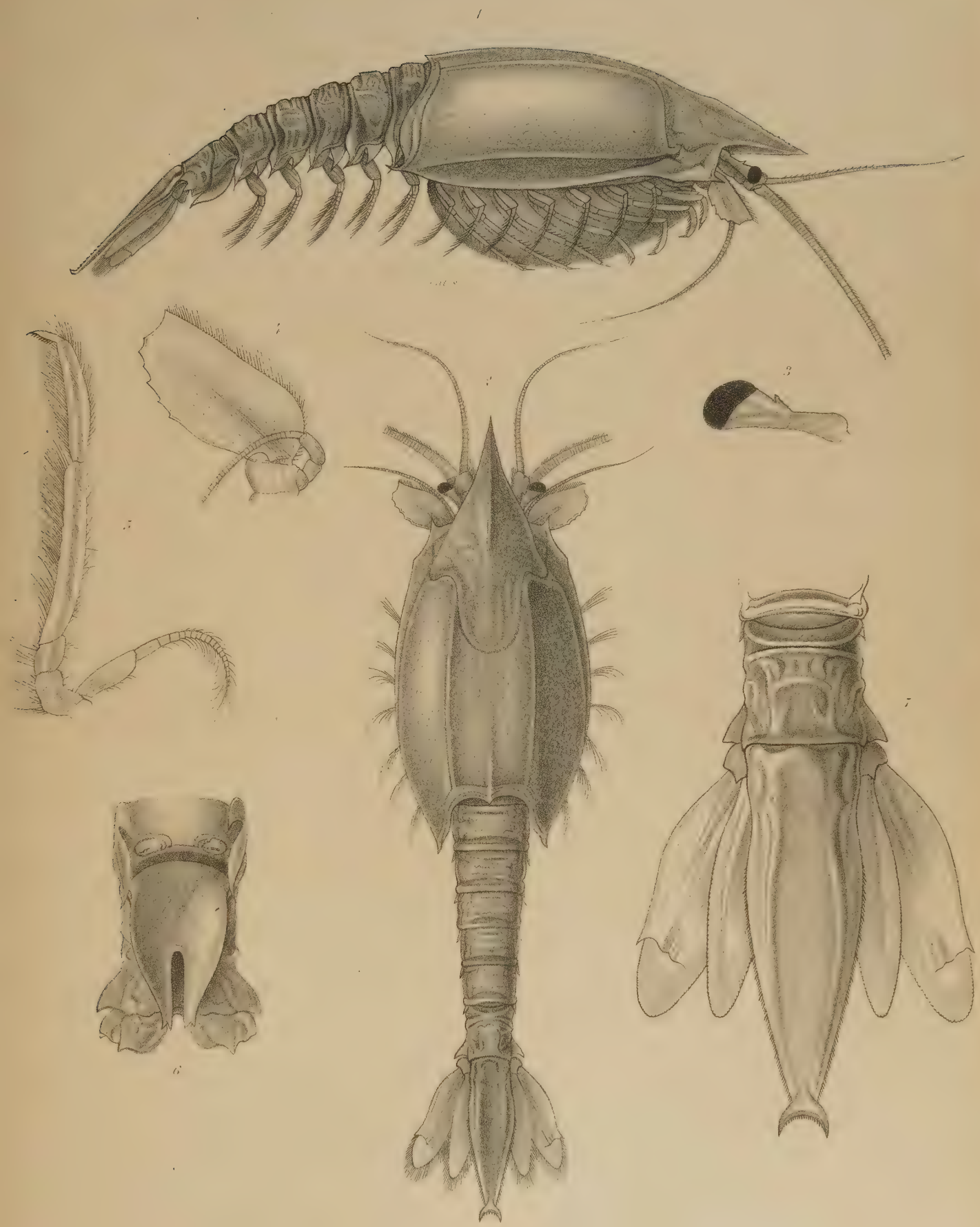
Fig. 3. An eye.

Fig. 4. Antenna, with scale and proximal part of flagellum.

Fig. 5. One of the legs.

Fig. 6. The two last segments of tail, together with basal parts of uropoda, from below exhibiting the peculiar epimeral plates of last segment.

Fig. 7. Extremity of tail, with caudal fan, from above.



O. Sars, del.

GNATHOPHAUSIA INGENS, (Dohrn).

PLATE III.

PLATE III.

Gnathophausia gigas, Willemoes-Suhm.

Fig. 1. Adult male, from left side ; natural size.

Fig. 2. Same, from above.

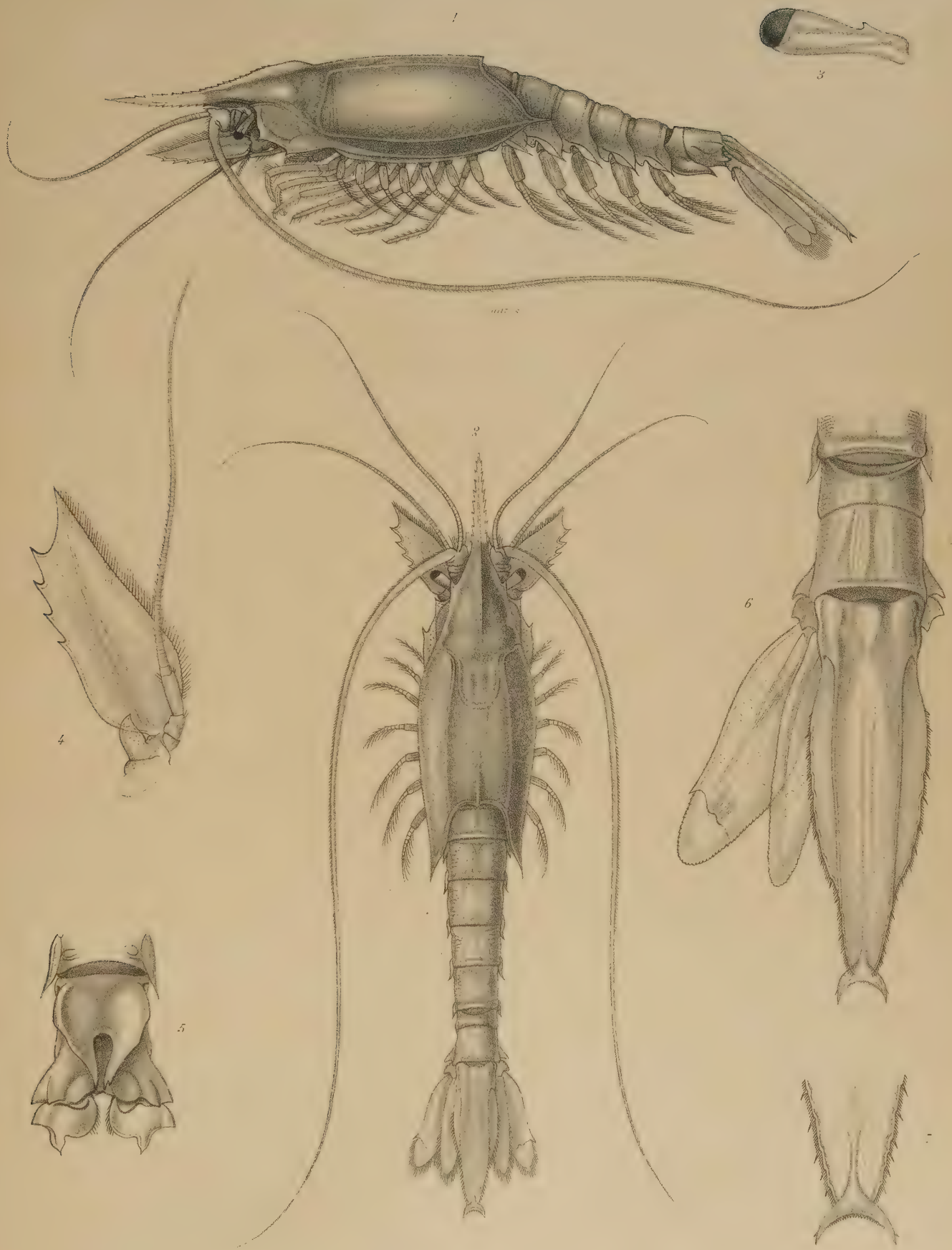
Fig. 3. An eye.

Fig. 4. Antenna, with scale and flagellum.

Fig. 5. Last caudal segment, with basal parts of uropoda, from below, exhibiting the confluent epimeral plates.

Fig. 6. Extremity of tail, with telson and right uropod, from above.

Fig. 7. Tip of telson ; somewhat more magnified.



G. O. Sars, del.

Lith. W. ... schter Stockholm.

GNATHOPHAUSIA GIGAS, Willem. Suhm.

PLATE IV.

PLATE IV.

Gnathophausia calcarata, G. O. Sars.

Fig. 1. Adult male, from right side ; very slightly magnified.

Fig. 2. Same, from above.

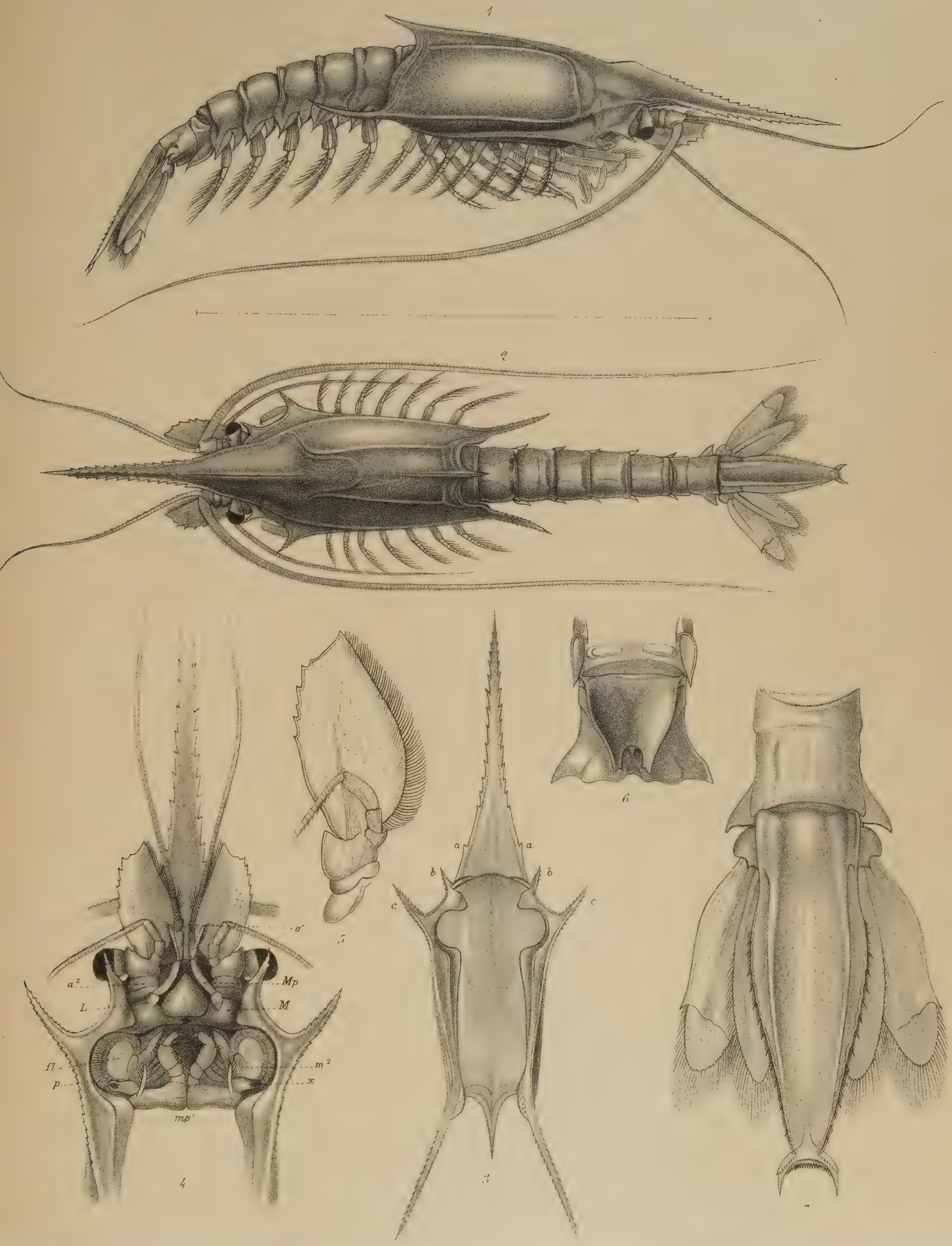
Fig. 3. Carapace of another somewhat smaller specimen, from below. *a*, supra-orbital spines (?) ; *b*, antennal spines ; *c*, branchiostegal spines.

Fig. 4. Anterior part of body, from below, exhibiting eyes, antennulæ (a',), antennæ (a^2), anterior lip (*L*), mandibles (*M*), mandibular palps (*Mp*), second pair of maxillæ (m^2), with their exognaths (*fl*), and the pigmented basal protuberance (*x*), maxillipeds (mp'), with their rudimentary exopodite (*p*).

Fig. 5. Antenna, with scale and proximal part of flagellum.

Fig. 6. Last caudal segment, from below, exhibiting the confluent epimeral plates.

Fig. 7. Extremity of tail, with caudal fan, from above.



Sars, del.

Lith. W. Schlachter, Stockholm

GNATHOPHAUSIA CALCARATA, n. sp

PLATE V.

PLATE V.

Figs. 1–6. *Gnathophausia willemoesii*, G. O. Sars.

Fig. 1. Adult female, from left side; natural size.

Fig. 2. Same, from above.

Fig. 3. An eye.

Fig. 4. Antenna, with scale and flagellum.

Fig. 5. The two last caudal segments, with basal parts of uropoda, from below.

Fig. 6. Telson, from above.

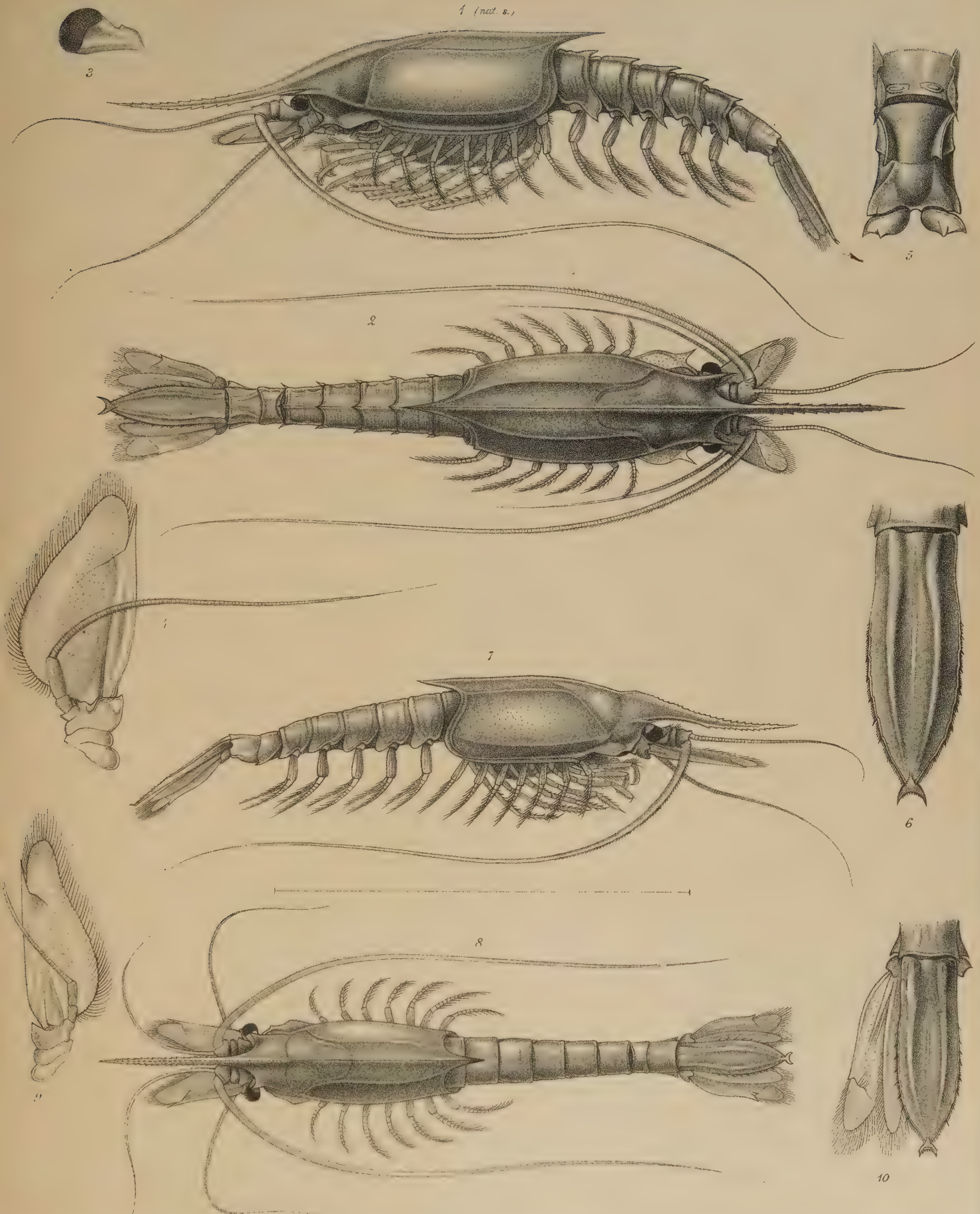
Figs. 7–10. *Gnathophausia affinis*, G. O. Sars.

Fig. 7. Female, from right side; slightly magnified.

Fig. 8. Same, from above.

Fig. 9. Antenna, with scale and proximal part of flagellum.

Fig. 10. Extremity of tail, with telson and right uropod, from above.



G. O. Sars, del.

Lith. W. Schlachter Stockholm

Figs. 1–6, GNATHOPHAUSIA WILLEMOESII, n. sp
„ 7–10, „ AFFINIS, n. sp.

PLATE VI.

PLATE VI.

Figs. 1–5. *Gnathophausia elegans*, G. O. Sars.

Fig. 1. Female, from left side ; magnified about three times.

Fig. 2. Same, from above.

Fig. 3. Antenna, with scale and proximal part of flagellum.

Fig. 4. Telson, from above.

Fig. 5. Extremity of same; more highly magnified.

Figs. 6–10. *Gnathophausia zoëa*, Willemoes-Suhm.

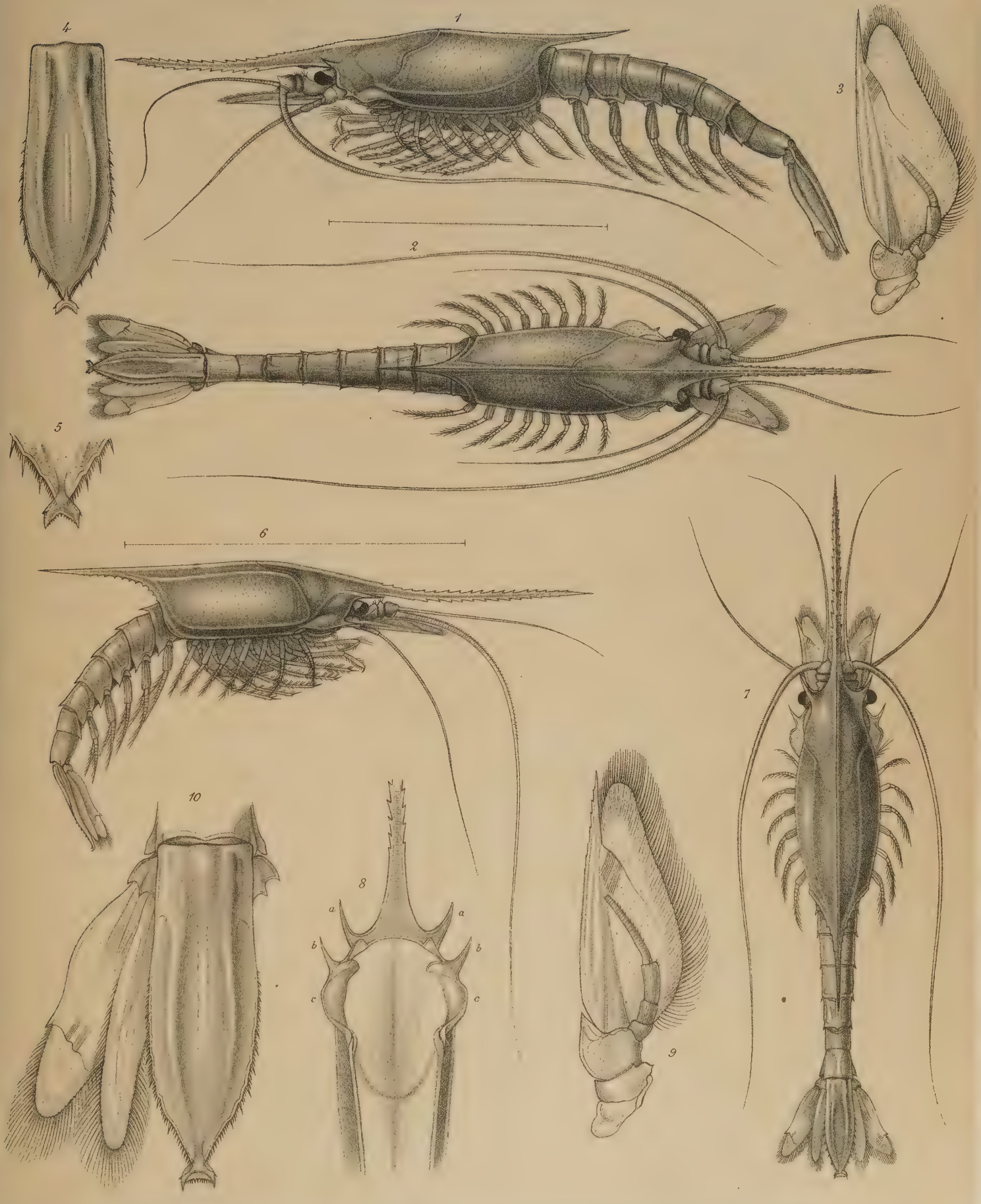
Fig. 6. Adult female, from right side ; twice the natural size.

Fig. 7. Same, from above.

Fig. 8. Anterior part of carapace, with base of rostrum, from below. *a*, supra-orbital spines ; *b*, antennal spines ; *c*, branchiostegal expansions.

Fig. 9. Antenna, with scale and proximal part of flagellum.

Fig. 10. Extremity of tail, with telson and right uropod, from above.



G. O. Sars, del.

Lith. W. Schlachter

Figs. 1–5, GNATHOPHAUSIA ELEGANS, n. sp.
„ 6–10, „ ZOEA, Willem. Suhm

PLATE VII.

PLATE VII.

Figs. 1–5. *Gnathophausia longispina*, G. O. Sars.

Fig. 1. Adult male, from left side ; magnified about three times.

Fig. 2. Same, from above.

Fig. 3. Antenna, with scale and proximal part of flagellum.

Fig. 4. Extremity of tail, with telson, from above.

Fig. 5. Anterior part of carapace, with base of rostrum, from below. *a*, supra-orbital spines ; *b*, rudiments of antennal spines ; *c*, branchiostegal spines.

Figs. 6–10. *Gnathophausia gracilis*, Willemoes-Suhm.

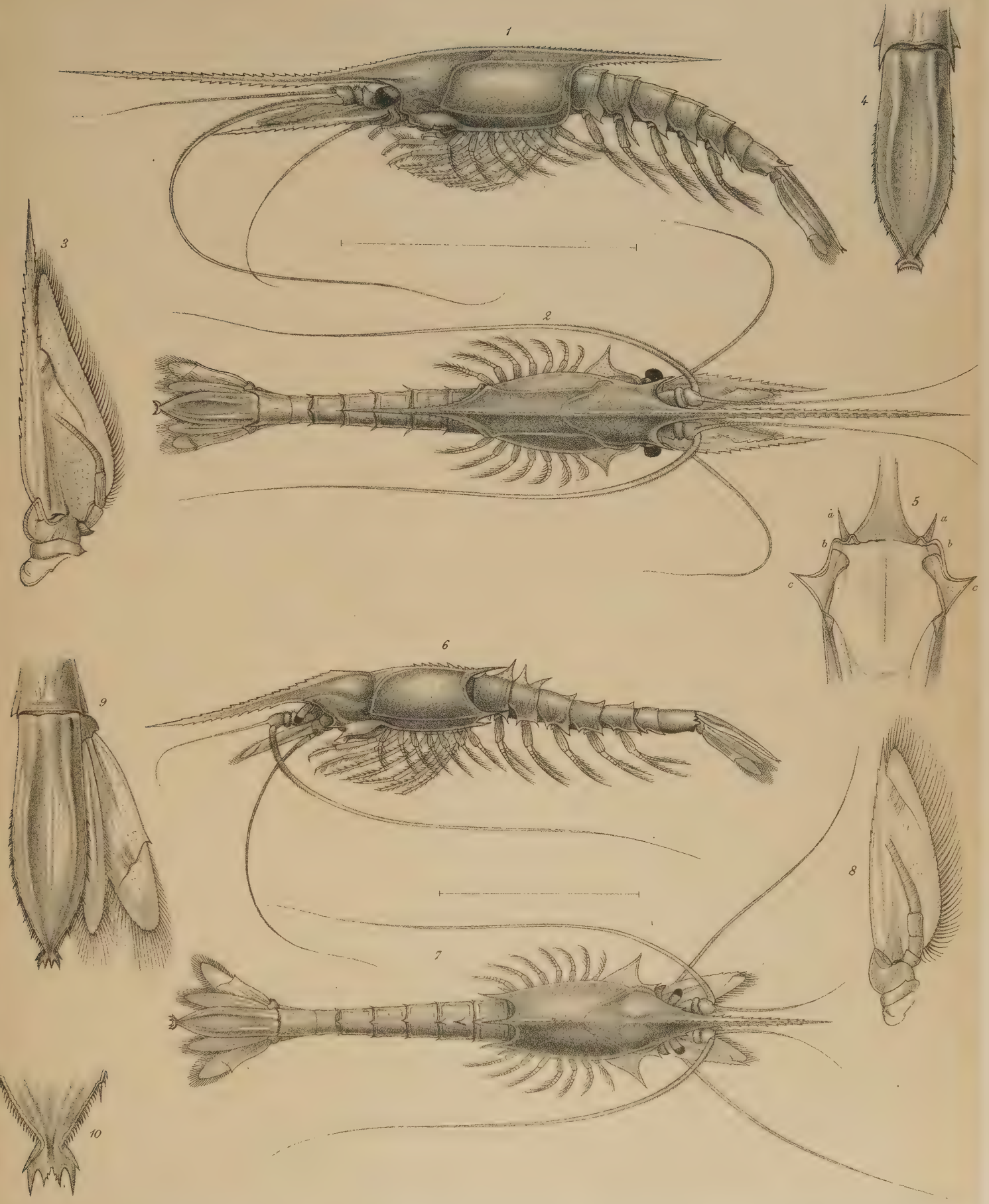
Fig. 6. Male, from left side ; magnified about three times.

Fig. 7. Same, from above.

Fig. 8. Antenna, with scale and proximal part of flagellum.

Fig. 9. Extremity of tail, with telson and right uropod, from above.

Fig. 10. Tip of telson ; more highly magnified.



G. O. Sars, del.

Figs. 1–5, GNATHOPHAUSIA LONGISPINA, n. sp.
„ 6–10, „ GRACILIS, Willem. Suhm.

PLATE VIII.

PLATE VIII.

Gnathophausia longispina, G. O. Sars.

(Anatomy).

Fig. 1. Ocular segment, with right eye (*o*) and right antennular peduncle, from above.

Fig. 2. Anterior lip (*L*) and mandibles with their palps, from below.

Fig. 3. Terminal joint of mandibular palp; more highly magnified.

Fig. 4. Cutting edges of mandibles.

Fig. 5. Posterior lip.

Fig. 6. Maxillæ of first pair, with palp.

Fig. 7. Maxillæ of second pair. *p*, palp; *ex*, exognath; *x*, pigmented basal protuberance.

Fig. 8. Maxilliped. *x*, concave surface occurring in place of the exopodite; *ep*, epipodite.

Fig. 9. Leg of first pair, or gnathopod, with attached gill.

Fig. 10. Leg of second pair. *ep*, rudimentary epipod.

Fig. 11. Bases of a pair of legs, with the attached gills *in situ*.

Fig. 12. Gill, isolated.

Fig. 13. Extremity of a gill-branch; more highly magnified.

Fig. 14. Leg of last pair, with male sexual aperture (*p*) and the rudimentary gill (*br*).

Fig. 15. Male sexual aperture; more highly magnified.

Fig. 16. Trunk, with maxillipeds, legs, and gills *in situ*, viewed from the ventral face.

Fig. 17. Trunk, together with first caudal segment and oral parts, from right side. The carapace is removed to show the seven segments of the trunk with their gills. *L*, anterior lip; *M*, mandible; *p*, mandibular palp; *m'*, maxilla of first pair; m^2, maxilla of second pair; *x*, pigmented basal protuberance of same; *mp'*, maxilliped; *ep*, epipodite of same; mp^2, leg of first pair or gnathopod.

Fig. 18. A pleopod.

Fig. 19. Chain of ventral ganglia; 1–9 those belonging to anterior division, following (1–6) caudal.

Fig. 20. Part of the anterior division of the chain, together with the great ventral artery (*a*); more highly magnified.

G. O. Sars, del.

Lith. W. Schlachter Stockholm.

GNATHOPHAUSIA LONGISPINA.
(Anatomy)

PLATE IX.

PLATE IX.

Eucopia australis, Dana.

Fig. 1. Adult female with marsupial pouch, from right side; magnified about three times. The exterior parts of the four posterior pairs of legs were broken off.

Fig. 2. Same, from above.

Fig. 3. Ocular segment, with left eye and antennular peduncles, from above.

Fig. 4. Antenna, with scale and proximal part of flagellum.

Fig. 5. Anterior lip and mandibles *in situ*, from below.

Fig. 6. Masticatory parts of mandibles, exhibiting the armature of the cutting edges.

Fig. 7. Last joint of mandibular palp.

Fig. 8. Posterior lip.

Fig. 9. Maxilla of first pair.

Fig. 10. Extremity of outer masticatory lobe of same; more highly magnified.

Fig. 11. Maxilla of second pair.

Fig. 12. Maxilliped, with the rudimentary exopodite and greatly developed epipodite.

Fig. 13. Extremity of endopodite of same; more highly magnified.

Fig. 13 (*bis*). Leg of first pair, or first gnathopod, with attached gill.

Fig. 14. Gill of same, isolated and more highly magnified.

Fig. 15. Leg of second pair, or second gnathopod, with attached gill and incubatory lamella.

Fig. 16. Extremity of same; more highly magnified.

Fig. 17. Leg of third pair, or third gnathopod.

Fig. 18. Extremity of same; more highly magnified.

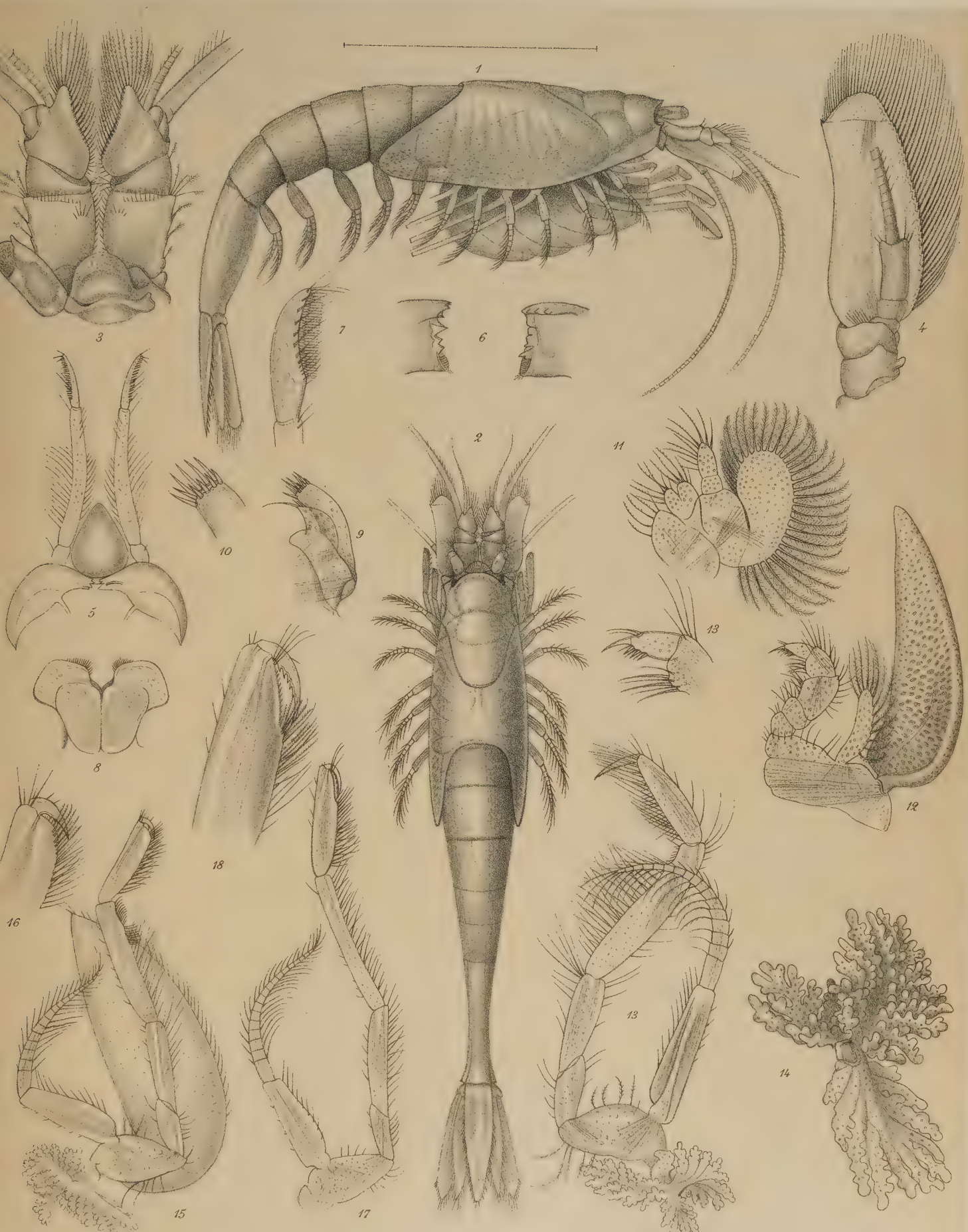

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PLATE X.

PLATE X.

Eucopia australis, Dana.

(*Continued*).

Fig. 1. Young female, with all its limbs uninjured, from left side; magnified about four times.

Fig. 2. Trunk, from left side, with attached limbs; carapace removed to show the segments and gills. *ep*, epipodite of maxilliped.

Fig. 3. Extremity of a gill-branch.

Fig. 4. One of its lobes; highly magnified.

Fig. 5. Leg of fourth pair, with attached gill.

Fig. 6. Extremity of same; more highly magnified.

Fig. 7. Extremity of a leg of last pair.

Fig. 8. A pleopod.

Fig. 9. Extremity of tail, with telson and left uropod, from above.

Fig. 10. Tip of telson; more highly magnified.

Fig. 11. Exterior corner, with part of apical edge of outer plate of uropod.

Fig. 12. Part of the nervous cord, comprising seven ganglia of the trunk and three caudal.

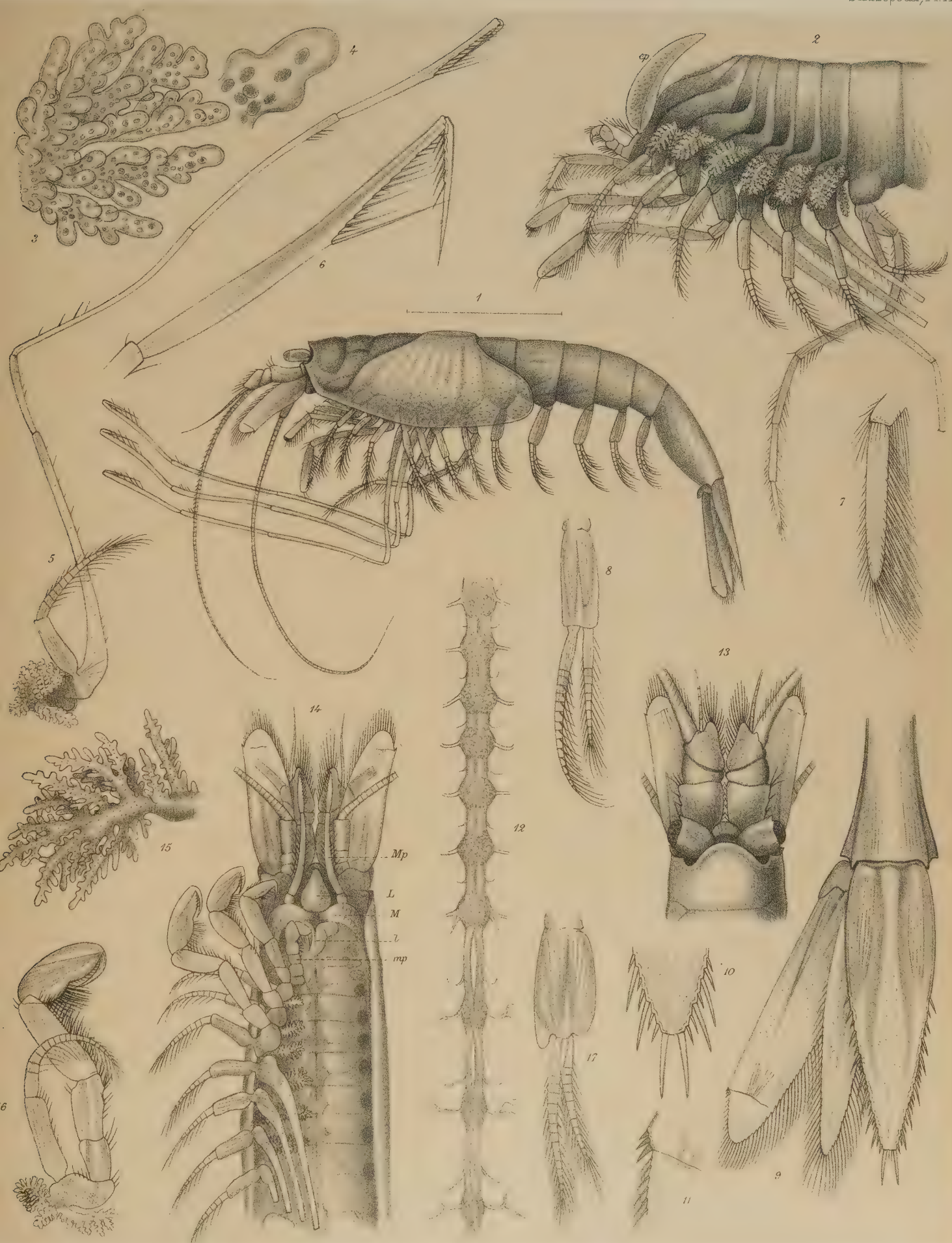
Fig. 13. Cephalic part of body of a male specimen, with eyes, antennulæ and antennæ, from above.

Fig. 14. Anterior part of body of same, from below. *L*, anterior lip; *M*, mandibles; *Mp*, mandibular palp; *l*, posterior lip; *mp*, maxilliped. The limbs behind the mandibles are only represented on the right side.

Fig. 15. A gill-branch of same.

Fig. 16. One of the posterior gnathopodous legs of same.

Fig. 17. A male pleopod.



EUCOPIA AUSTRALIS, Dana.

PLATE XI.

PLATE XI.

Euphausia pellucida, Dana.

Fig. 1. Adult female, from right side; magnified about nine times.

Fig. 2. Same, from above, showing the luminous globules shining through the integument.

Fig. 3. Preanal spine; highly magnified.

Fig. 4. Adult male, from left side.

Fig. 5. Anterior part of body of a female specimen, together with first caudal segment, from right side, showing the internal organs shining through the carapace. *st*, stomach; *l*, liver; *i*, intestine; *h*, heart; *ov*, ovary; *ovd*, oviduct.

Fig. 6. Carapace, with eyes, antennular peduncles; antennæ, anterior lip (*L*), mandibles (*M*), mandibular palps (*Mp*), and heart (*h*), from below.

Fig. 7. Ocular segment, with left eye, from below. *a*, larval eye or ocellus; *b*, luminous organ.

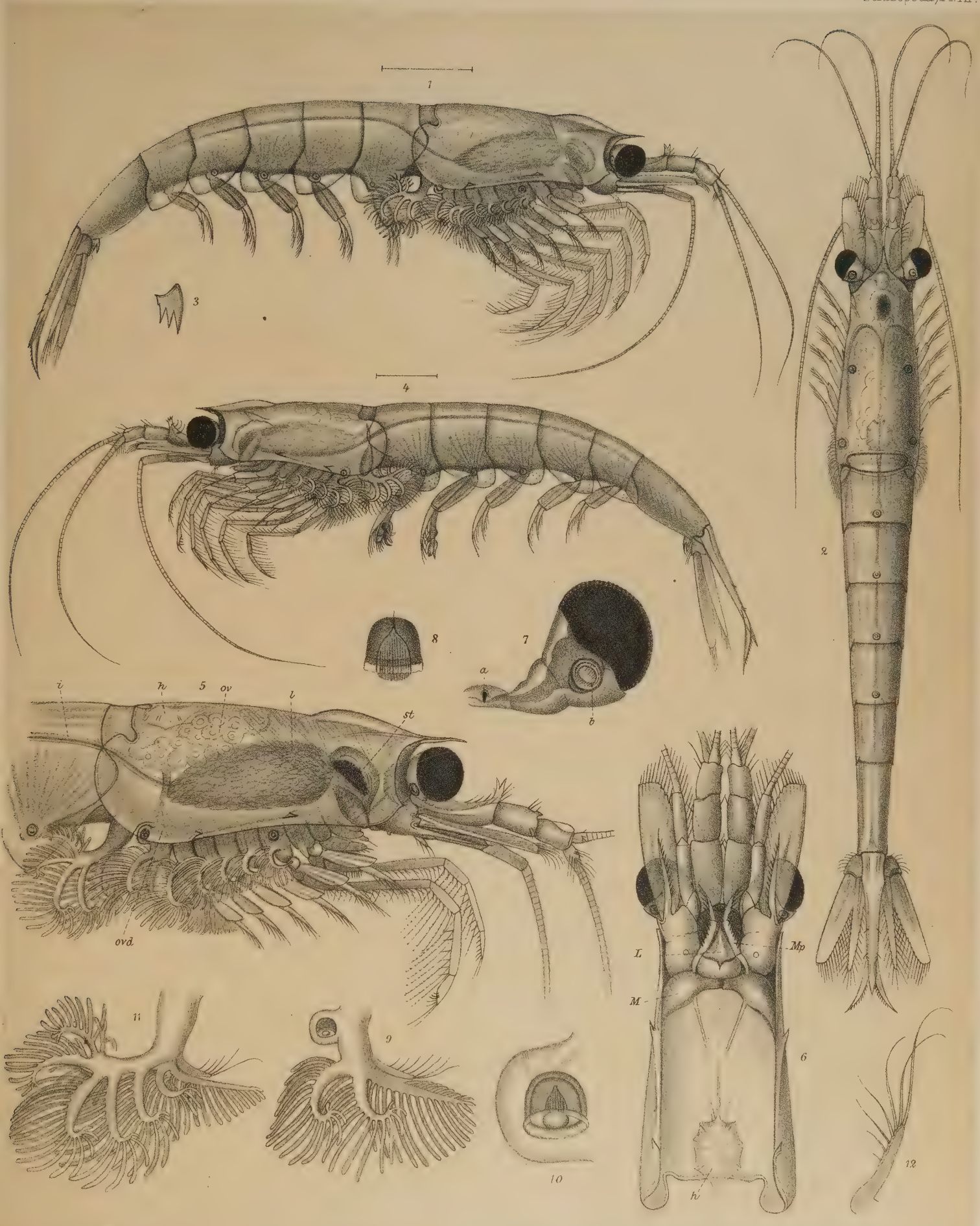
Fig. 8. Luminous organ of ocular pedicle, isolated and highly magnified.

Fig. 9. Gill of antepenultimate pair, with the bulbous basal expansion containing a luminous globule.

Fig. 10. The latter part; more highly magnified.

Fig. 11. Gill of last pair.

Fig. 12. Rudiment of a leg of penultimate pair; highly magnified.



G. O. Sars, del.

EUPHAUSIA PELLUCIDA, Dana.

Lith. W. Schlachter Stockholm

PLATE XII.

PLATE XII.

Euphausia pellucida, Dana.

(Anatomy—*continued.*)

Fig. 1. Right antennular peduncle, from above.
Fig. 2. Same, from inner side.
Fig. 3. Dorsal leaflet of same; highly magnified.
Fig. 4. Dorsal leaflet of another specimen, exhibiting numerous pointed lappets.
Fig. 5. Left antenna, with scale and proximal part of flagellum, from below.
Fig. 6. Same, from the outer side.
Fig. 7. Anterior lip.
Fig. 8. Posterior lip.
Fig. 9. Mandible.
Fig. 10. Masticatory parts of mandibles, more highly magnified, exhibiting the armature of the cutting edges.
Fig. 11. Mandibular palp.
Fig. 12. Maxilla of first pair.
Fig. 13. Maxilla of second pair.
Fig. 14. Maxilliped.
Fig. 15. Extremity of same; more highly magnified.
Fig. 16. Leg of first pair, with attached gill.
Fig. 17. Terminal joint of same; more highly magnified.
Fig. 18. Leg of second pair, with attached gill.
Fig. 19. Leg of antepenultimate pair, with attached gill.
Fig. 20. Gill of third pair.
Fig. 21. Gill of fourth pair.
Fig. 22. Extremity of a gill-stem, with seven of the digitiform lobules, highly magnified.
Fig. 23. Spermatophore found affixed to the genital orifice of a female specimen.
Fig. 24. A pair of pleopods of a female specimen, with the luminous organ projecting between their bases.
Fig. 25. Inner branch of a pleopod, without the marginal setæ.
Fig. 26. Luminous globule from the tail, isolated and highly magnified.
Fig. 27. Extremity of tail, with telson and right uropod, from below.
Fig. 28. Inner branch of a male pleopod of first pair, exhibiting the peculiar copulatory appendages.
Fig. 29. Inner branch of a male pleopod of second pair.
Fig. 30. Central part of the nervous system (nervous cord), with all the ganglia in their natural connection with each other, from below.

G. Sars, del.

Lith. W. Uehlander Stockholm

EUPHAUSIA PELLUCIDA, Dana.

(Anatomy).

PLATE XIII.

PLATE XIII.

Figs. 1–6. *Euphausia similis*, G. O. Sars.

Fig. 1. Adult male, from right side; magnified about six times.

Fig. 2. Anterior extremity of body, with eyes, antennulæ and antennæ, from above.

Fig. 3. Inner plate of a male pleopod of first pair.

Fig. 4. Inner plate of a male pleopod of second pair.

Fig. 5. Extremity of tail, with caudal fan, from above.

Fig. 6. Extremity of last caudal segment, with base of telson and uropods, from right side, more highly magnified, showing the simple preanal spine.

Figs. 7–17. *Euphausia splendens*, Dana.

Fig. 7. Adult female with spermatophores, from right side; magnified about seven times.

Fig. 8. Right antennular peduncle, from above.

Fig. 9. Right antenna, from below.

Fig. 10. Mandibular palp.

Fig. 11. Maxilla of first pair

Fig. 12 Maxilla of second pair

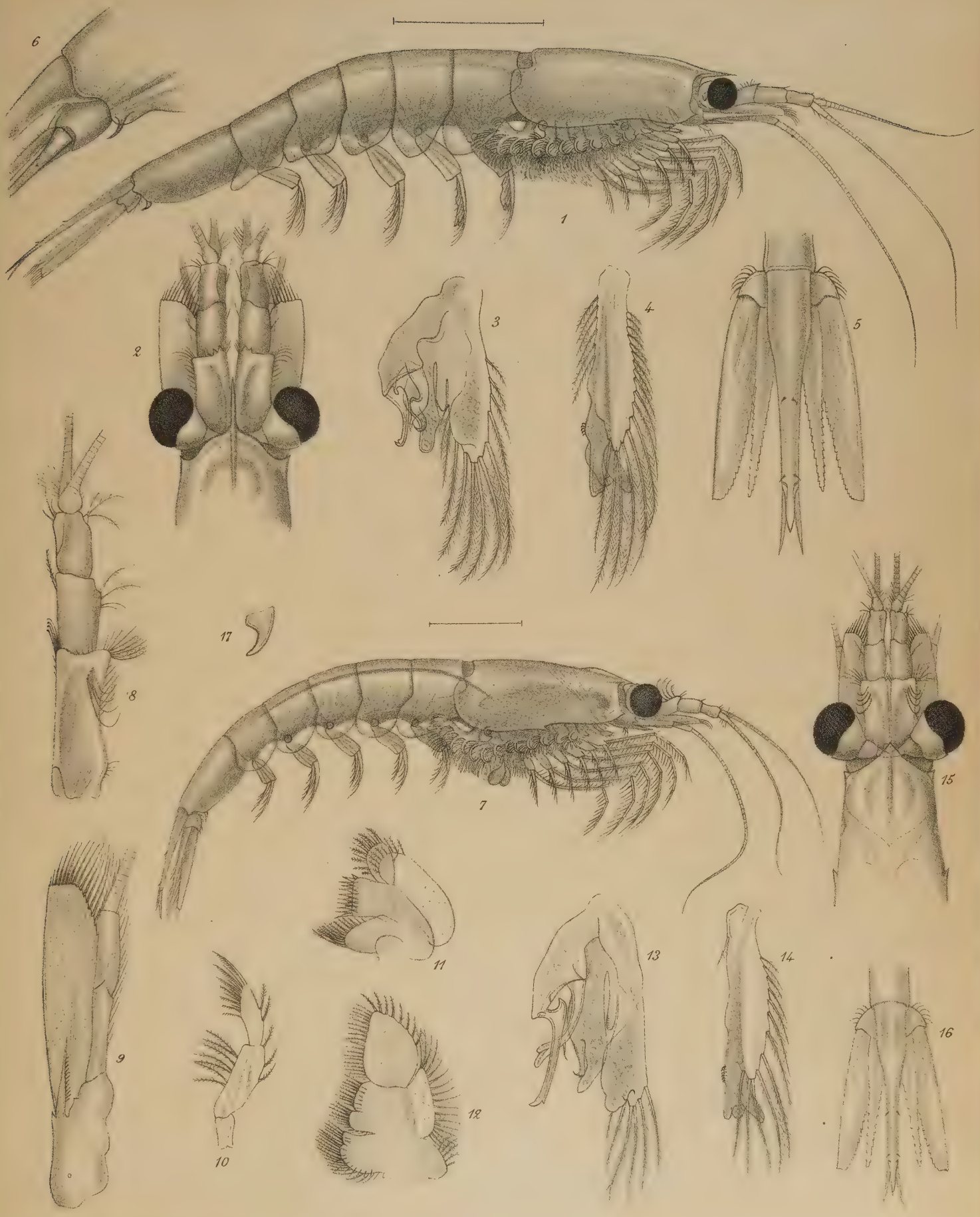
Fig. 13. Inner plate of a male pleopod of first pair.

Fig. 14. Inner plate of a male pleopod of second pair.

Fig. 15. Anterior part of body, from above.

Fig. 16. Extremity of tail, with caudal fan, from above.

Fig. 17. Preanal spine.



G. O. Sars, del.

Lith. W. Schlachter, Stockholm

Figs 1–6, EUPHAUSIA SIMILIS, n. sp.
„ 7–17, „ SPLENDENS, Dana.

PLATE XIV.

PLATE XIV.

Figs. 1–4. *Euphausia murrayi*, G. O. Sars.

Fig. 1. Female, from right side ; magnified about four times.

Fig. 2. Anterior part of body, from above.

Fig. 3. One of the anterior gills.

Fig. 4. Extremity of tail, with caudal fan, from above.

Figs. 5–9. *Euphausia superba*, Dana.

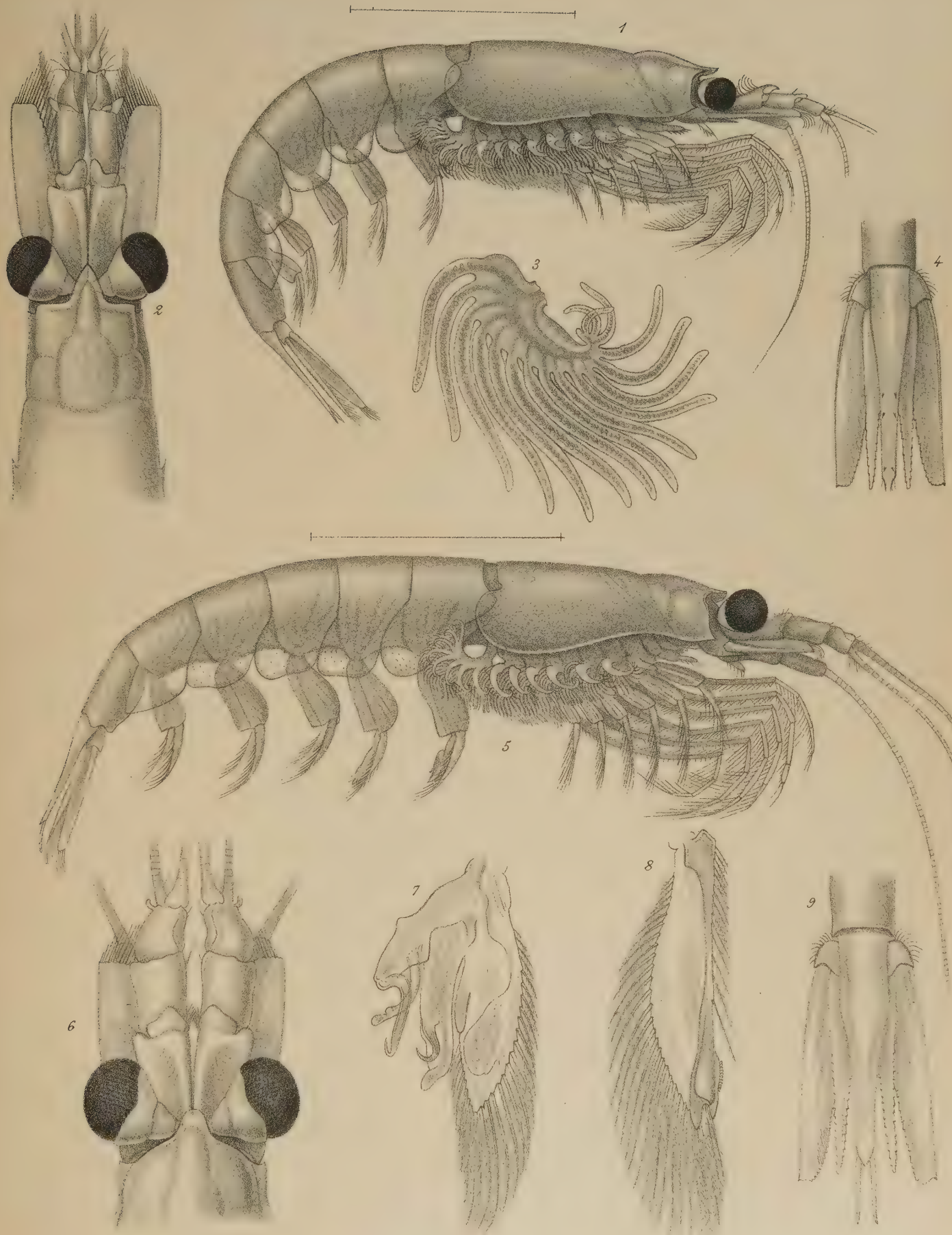
Fig. 5. Adult male, from right side ; magnified about four times.

Fig. 6. Anterior part of body, from above.

Fig. 7. Inner plate of a male pleopod of first pair.

Fig. 8. Inner plate of a male pleopod of second pair.

Fig. 9. Extremity of tail, with caudal fan, from above.



G. O. Sars, del.

Lith. W. Schlachter . tockholm.

Figs 1—4, EUPHAUSIA MURRAYI, n. sp.
„ 5—9, „ SUPERBA, Dana.

PLATE XV.

PLATE XV.

Figs. 1–8. *Euphausia antarctica*, G. O. Sars.

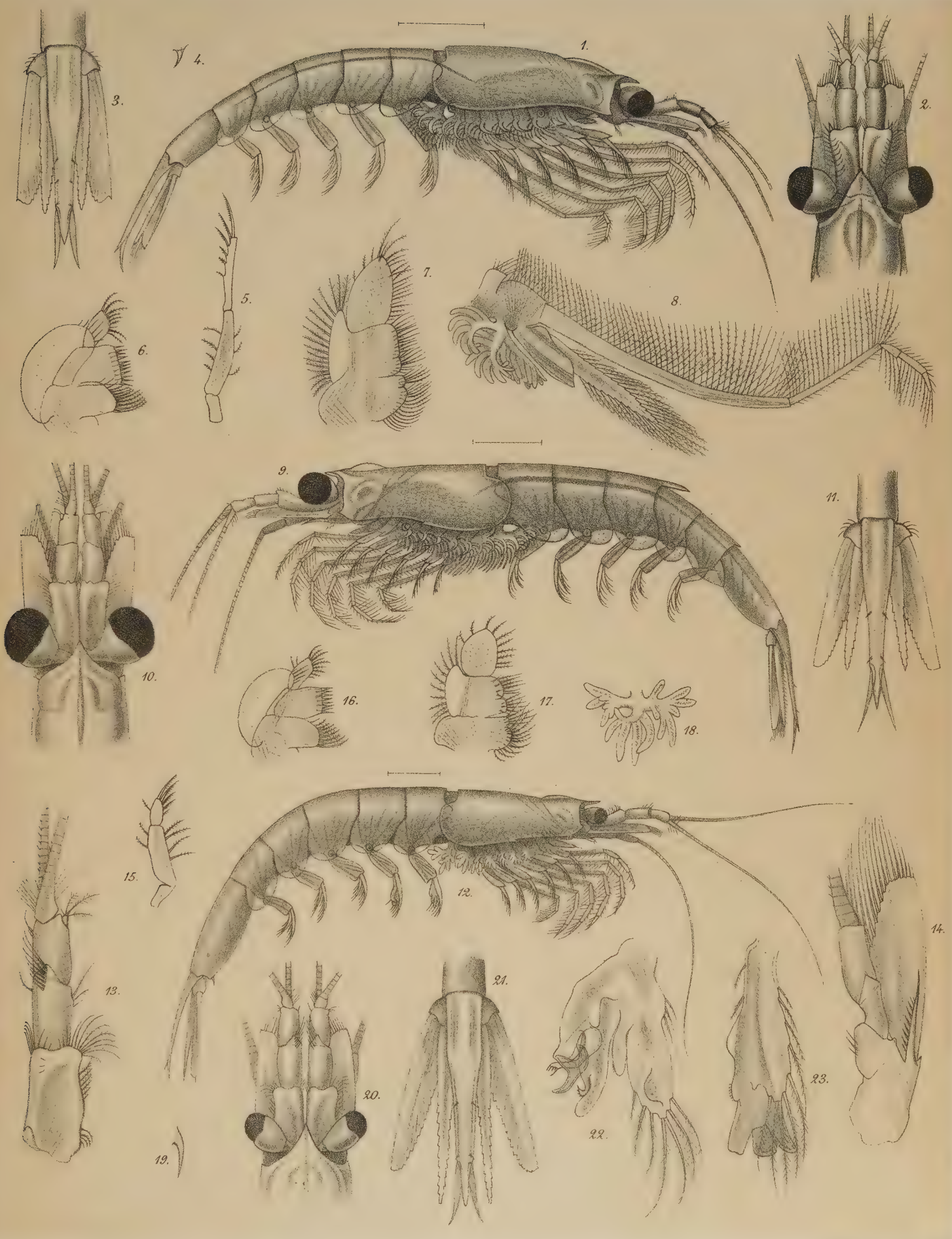
Fig. 1. Female, from right side; magnified about eight times.
Fig. 2. Anterior part of body, from above.
Fig. 3. Extremity of tail, with caudal fan, from above.
Fig. 4. Preanal spine.
Fig. 5. Mandibular palp.
Fig. 6. Maxilla of first pair.
Fig. 7. Maxilla of second pair.
Fig. 8. Leg of antepenultimate pair, with attached gill.

Figs. 9–11. *Euphausia mucronata*, G. O. Sars.

Fig. 9. Adult female, from left side; magnified about ten times.
Fig. 10. Anterior part of body, from above.
Fig. 11. Extremity of tail, with caudal fan, from above.

Figs. 12–23. *Euphausia gracilis*, Dana.

Fig. 12. Adult male, from right side; magnified about twelve times.
Fig. 13. Right antennular peduncle, from above.
Fig. 14. Left antenna, from below.
Fig. 15. Mandibular palp.
Fig. 16. Maxilla of first pair.
Fig. 17. Maxilla of second pair.
Fig. 18. Gill of last pair.
Fig. 19. Preanal spine.
Fig. 20. Anterior part of body, from above.
Fig. 21. Extremity of tail, with caudal fan, from above.
Fig. 22. Inner plate of a male pleopod of first pair.
Fig. 23. Inner plate of a male pleopod of second pair.



G. O. Sars, del.

Lith. W. Schlachter. Stockholm.

Figs 1–8, EUPHAUSIA ANTARCTICA, n. sp. Figs 9–11, EUPHAUSIA MUCRONATA, n. sp.
Figs 12–23, EUPHAUSIA GRACILIS, Dana.

PLATE XVI.

PLATE XVI.

Figs. 1–8. *Euphausia gibba*, G. O. Sars.

Fig. 1. Adult male, from left side; magnified about ten times.

Fig. 2. Anterior part of body, from above.

Fig. 3. Extremity of tail, with caudal fan, from above.

Fig. 4. Rudimentary dorsal lobe of antennular peduncle; highly magnified.

Fig. 5. Left antenna, from below.

Fig. 6. Inner plate of a male pleopod of first pair.

Fig. 7. Inner plate of a male pleopod of second pair.

Fig. 8. Gill of last pair.

Figs. 9–16. *Euphausia spinifera*, G. O. Sars.

Fig. 9. Adult male, from right side; magnified about six times.

Fig. 10. Anterior part of body, from above.

Fig. 11. Extremity of tail, with caudal fan, from above.

Fig. 12. Dorsal lobe springing from basal joint of antennulæ; highly magnified.

Fig. 13. Spine-like dorsal lobe from second joint of antennulæ.

Fig. 14. Inner plate of a male pleopod of first pair.

Fig. 15. Inner plate of a male pleopod of second pair.

Fig. 16. Preanal spine.

Figs. 17–23. *Euphausia latifrons*, G. O. Sars.

Fig. 17. Male, from right side; magnified about twenty times.

Fig. 18. Anterior part of body, from above.

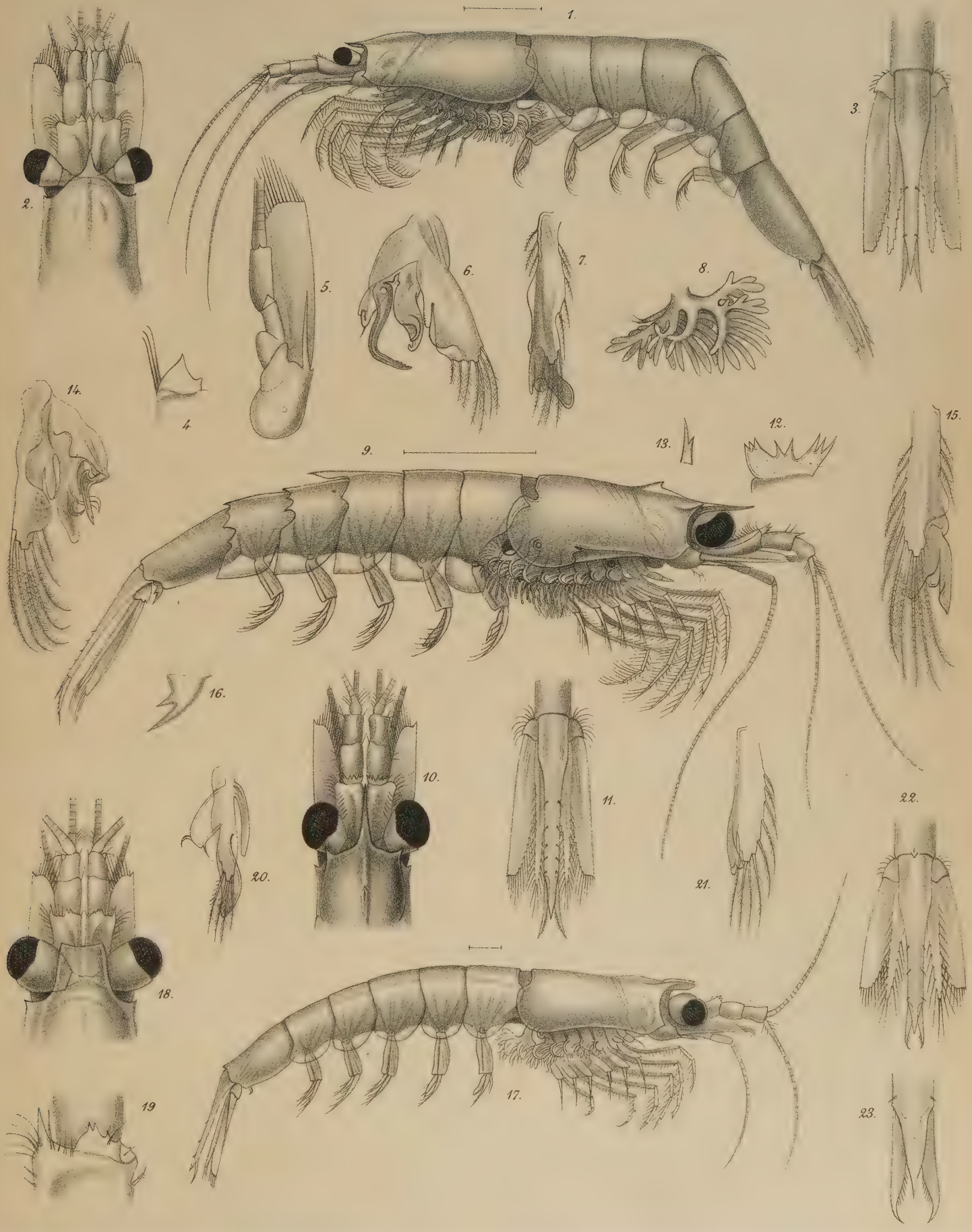
Fig. 19. Middle part of left antennular peduncle, from above, showing the dorsal lobe and the spine issuing from outer corner of basal joint.

Fig. 20. Inner plate of a male pleopod of first pair.

Fig. 21. Inner plate of a male pleopod of second pair.

Fig. 22. Extremity of tail, with caudal fan, from above.

Fig. 23. Tip of telson; more highly magnified.



G. O. Sars, del.

Lith. W. Schlachter Stockholm.

Figs 1–8, EUPHAUSIA GIBBA, n. sp. Figs 9–16, EUPHAUSIA SPINIFERA, n. sp.
Figs 17–23, EUPHAUSIA LATIFRONS, n. sp.

PLATE XVII.

PLATE XVII.

Thysanopoda tricuspidata, Milne-Edwards.

Fig. 1. Adult female, from left side; magnified about six times.

Fig. 2. Anterior part of body, from above.

Fig. 3. Extremity of tail, with caudal fan, from above.

Fig. 3*a*. Tip of terminal projection of telson; highly magnified.

Fig. 4. Preanal spine.

Fig. 5. Left antennular peduncle of a younger specimen, from above.

Fig. 6. Right antenna, from below.

Fig. 7. Anterior lip.

Fig. 8. Posterior lip.

Fig. 9. Mandible, with palp.

Fig. 10. Maxilla of first pair.

Fig. 11. Maxilla of second pair.

Fig. 12. Maxilliped.

Fig. 12*a*. Terminal joint of same; more highly magnified.

Fig. 13. Leg of first pair, with attached gill and luminous organ.

Fig. 13*a*. Terminal joint of same; more highly magnified.

Fig. 14. Leg of second pair, with attached gill.

Fig. 15. Leg of fifth pair, with attached gill.

Fig. 16. Leg of penultimate pair, with gill and luminous organ.

Fig. 17. Gill of posterior pair.

Fig. 17*a*. Rudiment of leg of last pair.

Fig. 19. Epipodite of maxilliped.

Fig. 20. Gill of first pair.

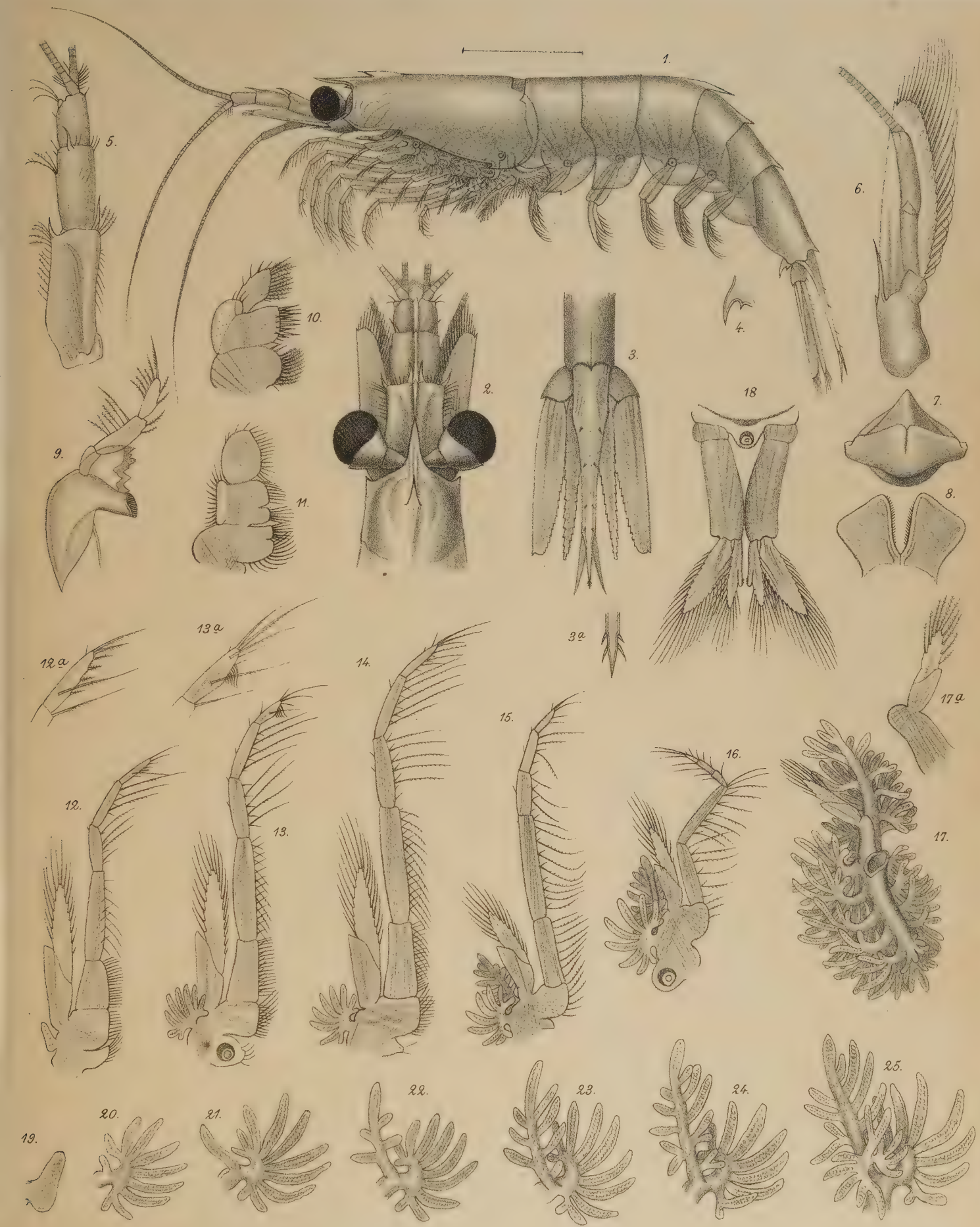
Fig. 21. Gill of second pair.

Fig. 22. Gill of third pair.

Fig. 23. Gill of fourth pair.

Fig. 24. Gill of fifth pair.

Fig. 25. Gill of sixth, or penultimate pair.



THYSANOPODA TRICUSPIDATA, M.-Edw.

PLATE XVIII.

PLATE XVIII.

Figs. 1–14. *Thysanopoda obtusifrons*,[1] G. O. Sars.

Fig. 1. Female, from left side; magnified about six times.

Fig. 2. Anterior part of body, from above.

Fig. 3. Extremity of tail, with caudal fan, from above.

Fig. 4. Left antennular peduncle, from inner side.

Fig. 5. Left antenna, with scale and proximal part of flagellum, from below.

Fig. 6. Mandibular palp.

Fig. 7. Maxilla of first pair.

Fig. 8. Maxilla of second pair.

Fig. 9. Terminal joint of a leg of first pair.

Fig. 10. One of the anterior gills.

Fig. 11. Leg of penultimate pair, with attached gill.

Fig. 12. Gill of posterior pair, with rudiment of leg.

Fig. 13. Inner plate of a male pleopod of first pair.

Fig. 14. Inner plate of a male pleopod of second pair.

Figs. 15–20. *Thysanopoda cristata*, G. O. Sars.

Fig. 15. Adult male, from right side; magnified about three times.

Fig. 16. Anterior part of body, from above.

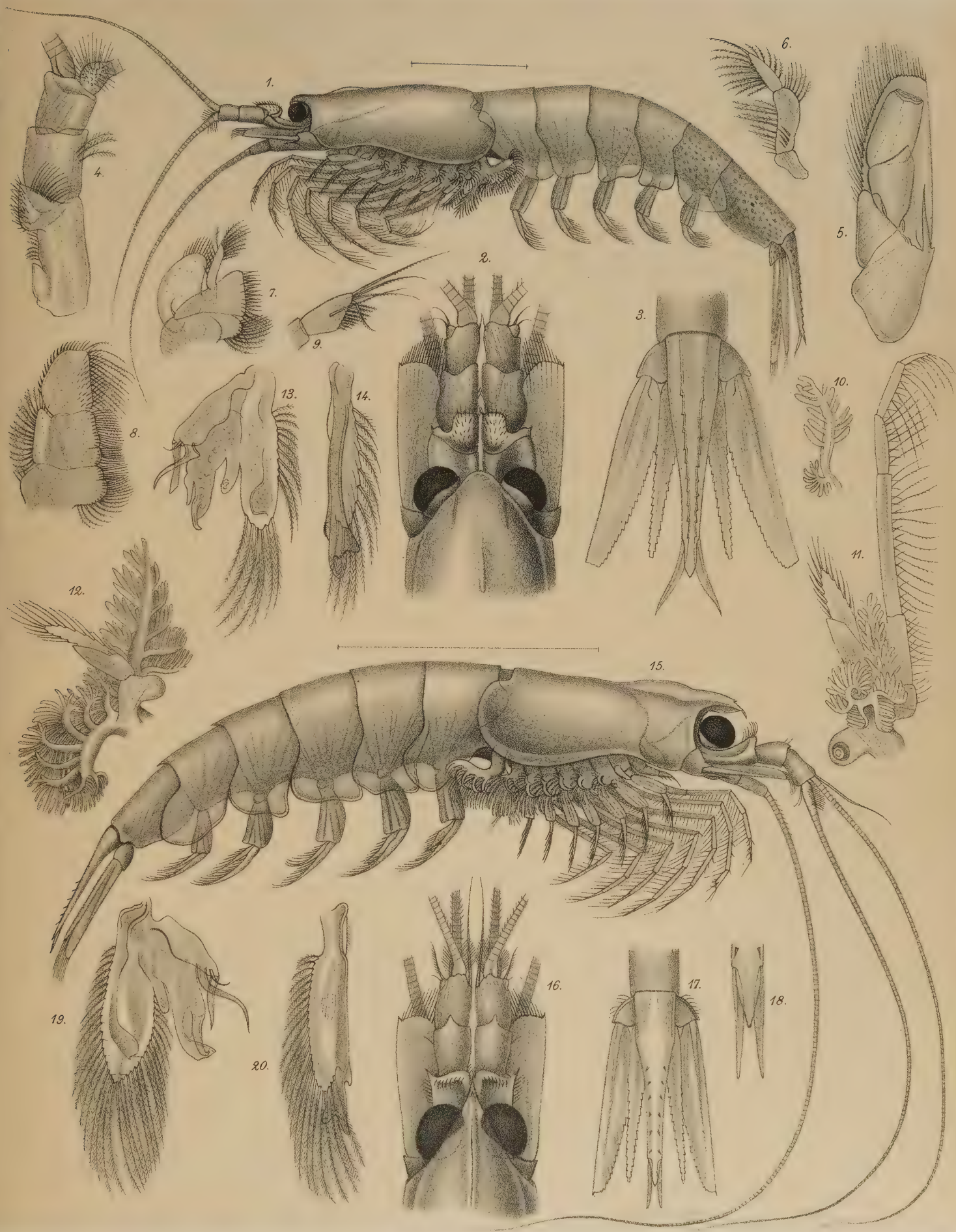
Fig. 17. Extremity of tail, with caudal fan, from above.

Fig. 18. Tip of telson; more highly magnified.

Fig. 19. Inner plate of a male pleopod of first pair.

Fig. 20. Inner plate of a male pleopod of second pair.

[1] *Thysanopoda obtusirostris* has been put in the plate by mistake.



G. O. Sars, del.

Lith. W. Schlachter

Figs. 1-14, THYSANOPODA OBTUSIROSTRIS, n. sp.
„ 15-20, „ CRISTATA, n. sp.

PLATE XIX.

PLATE XIX.

Bentheuphausia amblyops, G. O. Sars.

Fig. 1. Young female, from right side; magnified about eight times. The legs were broken off in the specimen.

Fig. 2. Anterior part of body, from above.

Fig. 3. Extremity of tail, with caudal fan, from above.

Fig. 4. Right eye, from above.

Fig. 5. Left antennular peduncle, from above.

Fig. 6. Same, from inner side.

Fig. 7. Right antenna, with scale and proximal part of flagellum, from below.

Fig. 8. Anterior lip.

Fig. 9. Posterior lip.

Fig. 10. Mandibles, from below. The masticatory part only is represented on right side.

Fig. 11. Left mandible, from outer face.

Fig. 12. Maxilla of first pair.

Fig. 13. Maxilla of second pair.

Fig. 14. Maxilliped.

Fig. 15. Masticatory lobe of same.

Fig. 16. Basal part of a leg of first pair, with attached gill.

Fig. 17. Basal part of a leg of fifth pair, with gill.

Fig. 18. Last pair of legs, with attached gills.

Fig. 19. Gill of first pair.

Fig. 20. Gill of second pair.

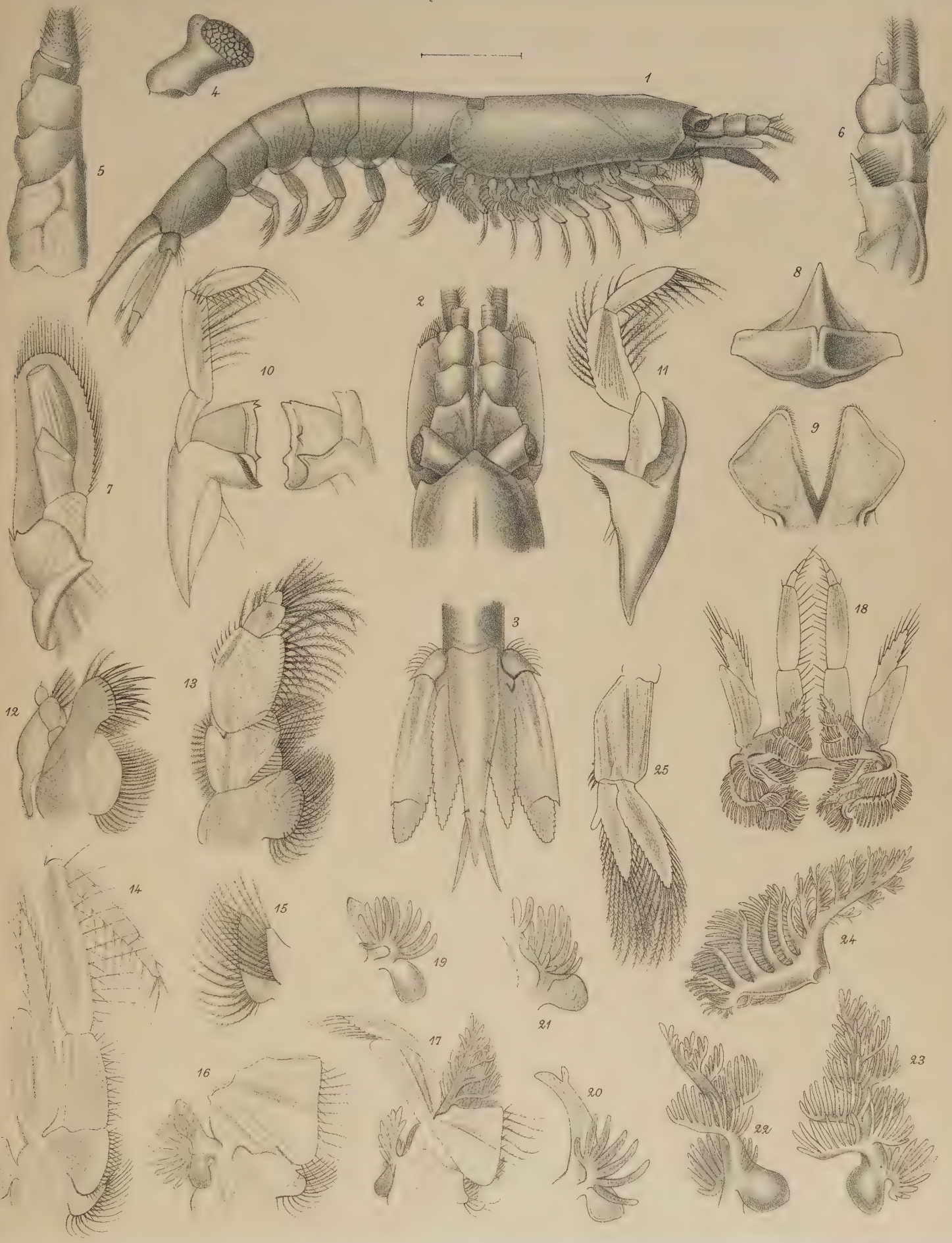
Fig. 21. Gill of third pair. Tip of inner branch broken off.

Fig. 22. Gill of fifth pair.

Fig. 23. Gill of sixth pair.

Fig. 24. Gill of last pair.

Fig. 25. A pleopod.



G. O. Sars, del.

BENTHEUPHAUSIA AMBLYOPS, n. gen. & sp.

PLATE XX.

PLATE XX.

Nyctiphanes australis, G. O. Sars.

Fig. 1. Ovigerous female, from left side; magnified about eight times.

Fig. 2. Anterior division of body, together with first caudal segment of same, viewed from the ventral face, to show the form of the double ovisac.

Fig. 3. Anterior part of body, from above.

Fig. 4. Right antennular peduncle, from above.

Fig. 5. Same, from inner side.

Fig. 6. Basal joint of same, from outer side.

Fig. 7. Right antenna, with scale and proximal part of flagellum, from below.

Fig. 8. Anterior lip.

Fig. 9. Posterior lip.

Fig. 10. Mandible, with palp.

Fig. 11. Cutting edges of mandibles.

Fig. 12. Maxilla of first pair.

Fig. 13. Maxilla of second pair.

Fig. 14. Maxilliped.

Fig. 14*a*. Terminal joint of same; more highly magnified.

Fig. 15. Leg of first pair, with gill and luminous organ.

Fig. 15*a*. Terminal joint of same; more highly magnified.

Fig. 16. Leg of second pair, with attached gill.

Fig. 17. Leg of fifth pair, with gill (exopod wanting).

Fig. 18. Leg of penultimate pair, with gill and luminous organ (exopod wanting).

Fig. 19. Gill of last pair, with rudiment of leg.

Fig. 20. Rudimentary leg of last pair, isolated, and more highly magnified.

Fig. 21. A pleopod.

Fig. 22. Extremity of tail, with caudal fan, from above.

Fig. 23. Tip of telson; more highly magnified.

NYCTIPHANES AUSTRALIS, n. gen & sp. ♀

PLATE XXI.

PLATE XXI.

Figs. 1–7. *Nyctiphanes australis*, G. O. Sars.

(*Continued.*)

Fig. 1. Adult male, from right side; magnified about eight times.

Fig. 2. Anterior part of body of same, from above.

Fig. 3. Posterior part of trunk, together with a part of first caudal segment, from above, exhibiting the peculiar form of the posterior emargination of the carapace.

Fig. 4. Left male antenna, with scale and proximal part of flagellum, from below.

Fig. 5. Leg of penultimate pair in male, with exopod and gill.

Fig. 6. Inner plate of a male pleopod of first pair.

Fig. 7. Inner plate of a male pleopod of second pair.

Figs. 8–17. *Thysanoëssa gregaria*, G. O. Sars.

Fig. 8. Adult female, from left side; magnified about seven times.

Fig. 9. Same, from above.

Fig. 10. Right eye, from anterior side.

Fig. 11. Same, from posterior side.

Fig. 12. Anterior part of body, from above.

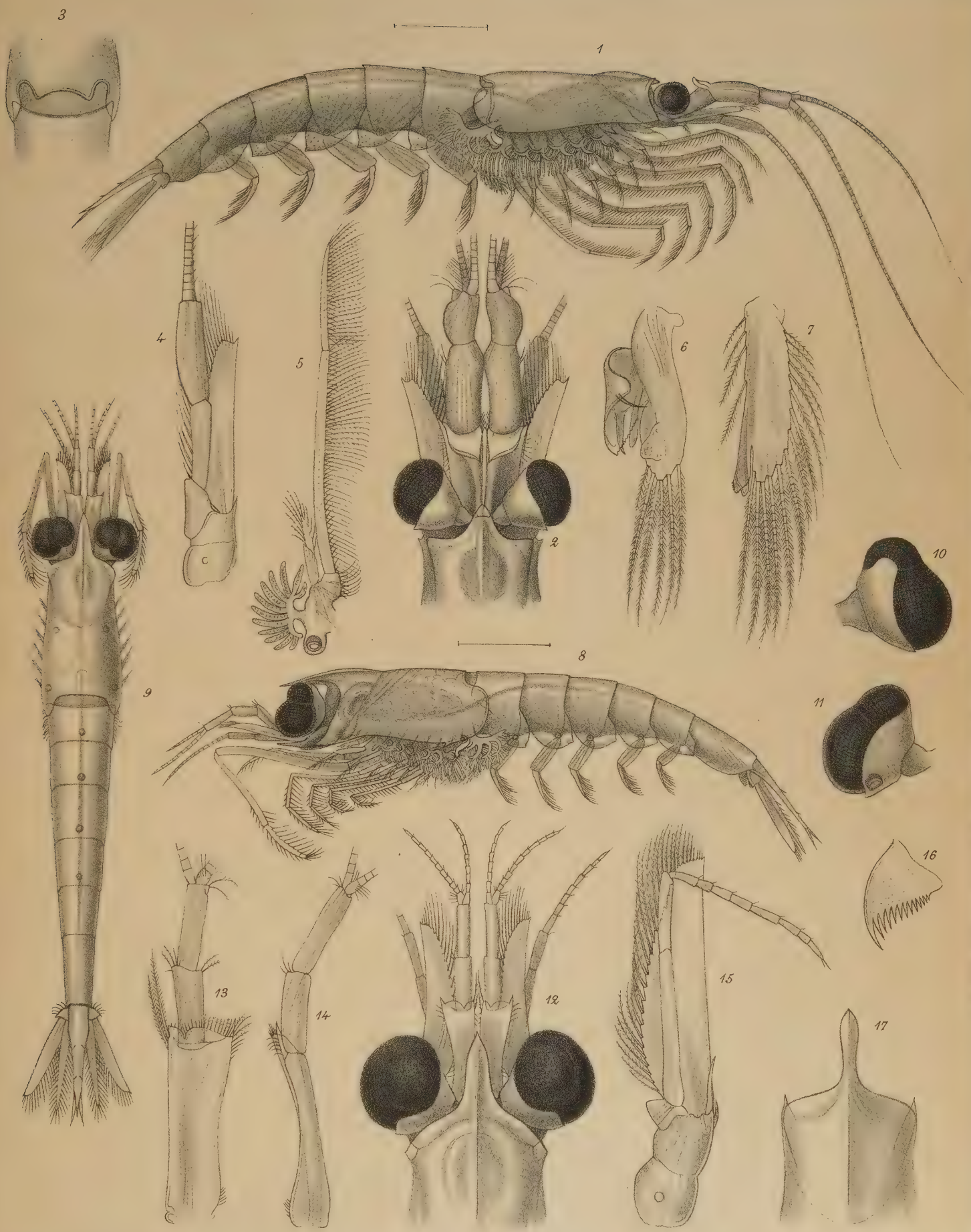
Fig. 13. Right antennular peduncle, from above.

Fig. 14. Same, from inner side.

Fig. 15. Left antenna, from below.

Fig. 16. Preanal spine.

Fig. 17. Anterior part of carapace of a male specimen, from above, showing the deviating form of the rostral projection.



Figs 1-7, NYCTIPHANES AUSTRALIS, n. sp. ♂
Figs 8-17, THYSANOËSSA GREGARIA, n. sp.

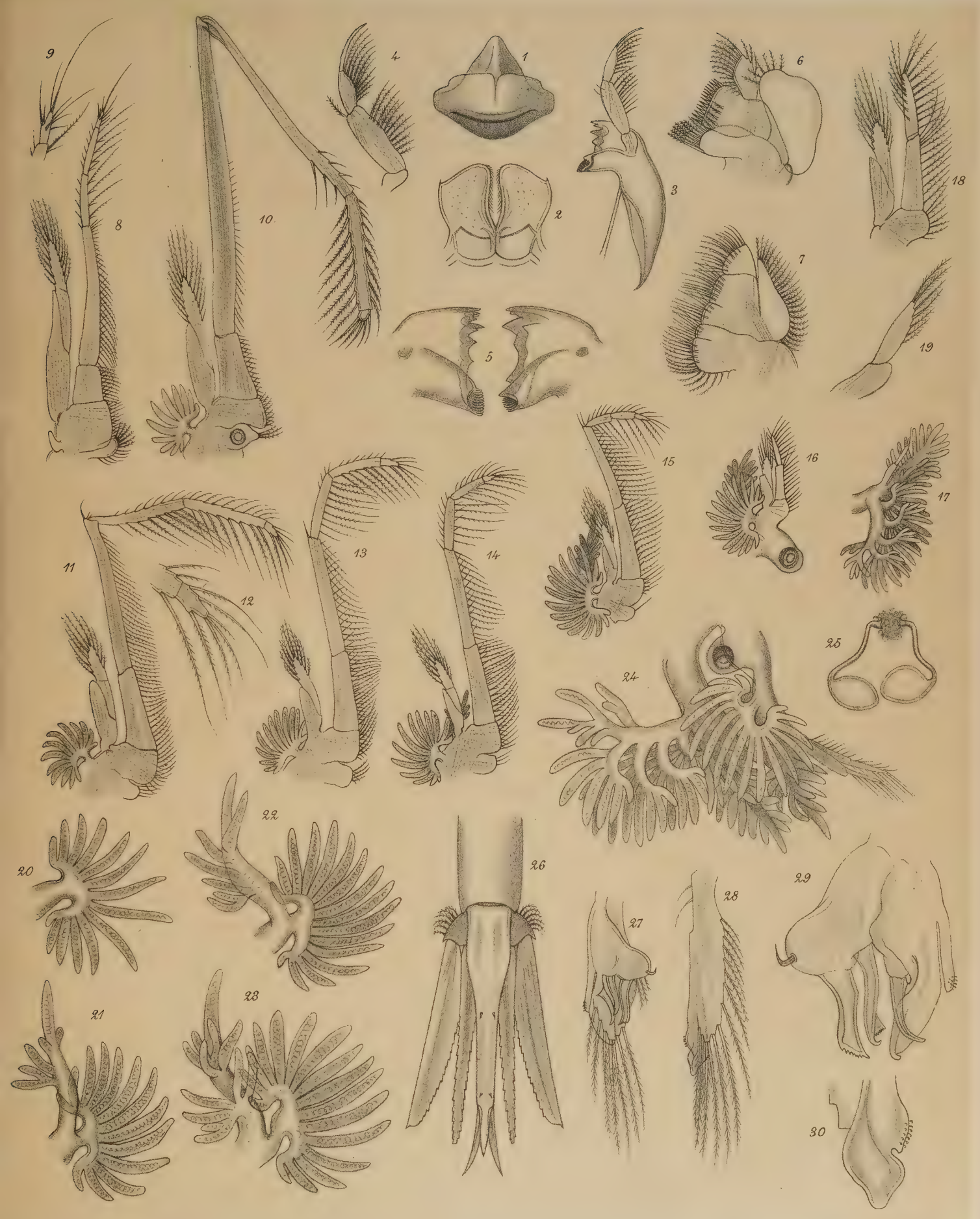
PLATE XXII.

PLATE XXII.

Thysanoëssa gregaria, G. O. Sars.

(Anatomy—*continued*).

Fig. 1. Anterior lip.
Fig. 2. Posterior lip.
Fig. 3. Mandible.
Fig. 4. Mandibular palp.
Fig. 5. Masticatory parts of mandibles, exhibiting the armature of the cutting edges.
Fig. 6. Maxilla of first pair.
Fig. 7. Maxilla of second pair.
Fig. 8. Maxilliped.
Fig. 9. Terminal joint of same; more highly magnified.
Fig. 10. Leg of first pair, with gill and luminous organ.
Fig. 11. Leg of second pair, with attached gill.
Fig. 12. Extremity of same; more highly magnified.
Fig. 13. Leg of third pair, with gill.
Fig. 14. Leg of fourth pair, with gill.
Fig. 15. Leg of fifth pair, with gill.
Fig. 16. Leg of penultimate pair, with gill and luminous organ.
Fig. 17. Gill of last pair, with rudiment of leg.
Fig. 18. Leg of penultimate pair, without gill and luminous organ; more highly magnified.
Fig. 19. Rudimentary leg of last pair.
Fig. 20. Gill of second pair.
Fig. 21. Gill of third pair.
Fig. 22. Gill of fourth pair.
Fig. 23. Gill of fifth pair.
Fig. 24. Gills of the two posterior pairs, on right side, *in situ*, from outer face.
Fig. 25. Spermatophores affixed to the genital openings of a female specimen.
Fig. 26. Extremity of tail, with caudal fan, from above.
Fig. 27. Inner plate of a male pleopod of first pair.
Fig. 28. Inner plate of a male pleopod of second pair.
Fig. 29. Copulatory appendage to first pleopod, isolated, and more highly magnified.
Fig. 30. Tip of copulatory appendage to second pleopod.



G. O. Sars, del.

Lith. W. Schlachter, Stockholm.

THYSANOËSSA GREGARIA, n. sp.
(Anatomy).

PLATE XXIII.

PLATE XXIII.

Figs. 1–4. *Thysanoëssa macrura*, G. O. Sars.

Fig. 1. Female, from left side; magnified about ten times.

Fig. 2. Anterior part of body, from above.

Fig. 3. Extremity of tail, with caudal fan, from above.

Fig. 4. Preanal spine.

Figs. 5–10. *Nematoscelis megalops*, G. O. Sars.

Fig. 5. Adult female, from right side; magnified about six times.

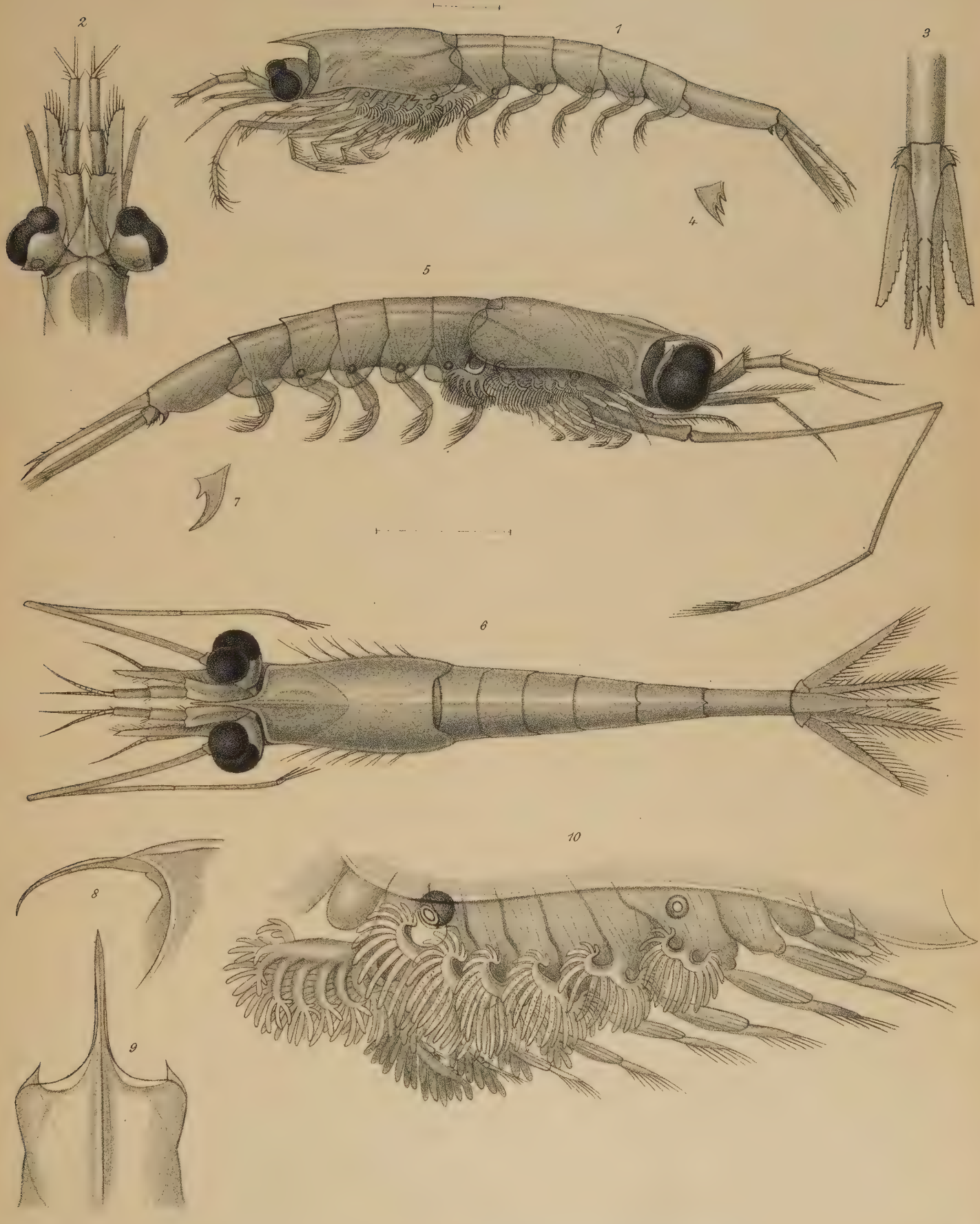
Fig. 6. Same, from above.

Fig. 7. Preanal spine.

Fig. 8. Anterior part of carapace, with the narrow rostral projection, from left side.

Fig. 9. Same, from above.

Fig. 10. Right side of trunk, with gills in their natural position.



G. O. Sars, del.

Lith. W. Schlachter, Stockholm.

Figs 1–4, THYSANÖESSA MACRURA, n. sp.
„ 5–10, NEMATOSCELIS MEGALOPS, n. gen. & sp.

PLATE XXIV.

PLATE XXIV.

Nematoscelis megalops, G. O. Sars.

(Anatomy—*continued.*)

Fig. 1. Anterior part of body, with eyes, antennulæ, antennæ, anterior lip, and mandibles, from below.

Fig. 2. Left antennular peduncle, from above.

Fig. 3. Left antenna, from below.

Fig. 4. Anterior lip.

Fig. 5. Posterior lip.

Fig. 6. Mandible, with palp.

Fig. 7. Masticatory parts of mandibles, exhibiting the armature of the cutting edges.

Fig. 8. Mandibular palp.

Fig. 9. Maxilla of first pair.

Fig. 10. Maxilla of second pair.

Fig. 11. Maxilliped.

Fig. 12. Terminal joint of same; more highly magnified.

Fig. 13. Leg of first pair

Fig. 14. Extremity of same; more highly magnified.

Fig. 15. Outer part of a terminal spine; highly magnified.

Fig. 16. Leg of second pair.

Fig. 17. Extremity of same; more highly magnified.

Fig. 18. Leg of third pair.

Fig. 19. Leg of fourth pair.

Fig. 20. Leg of fifth pair.

Fig. 21. Leg of penultimate pair.

Fig. 22. Same, without the gill and luminous organ; more highly magnified.

Fig. 23. Rudimentary leg of last pair.

Fig. 24. Gill of second pair.

Fig. 25. Gill of third pair.

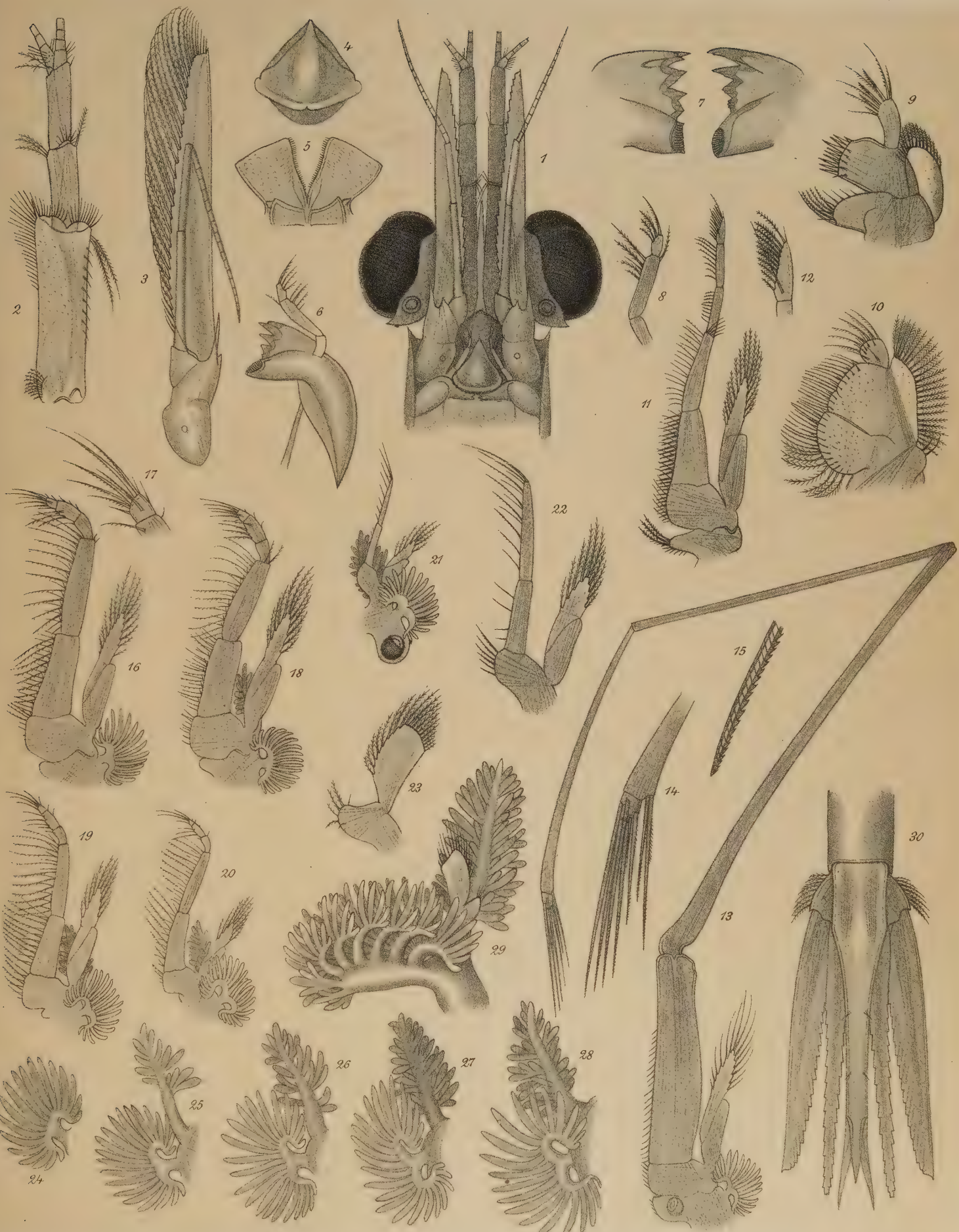
Fig. 26. Gill of fourth pair.

Fig. 27. Gill of fifth pair.

Fig. 28. Gill of penultimate pair.

Fig. 29. Gill of last pair, with rudiment of leg.

Fig. 30. Extremity of tail, with caudal fan, from above.



G. O. Sars, del.

Lith. W. Schlachter, Stockholm.

NEMATOSCELIS MEGALOPS, n. gen. & sp.
(Anatomy).

PLATE XXV.

PLATE XXV.

Figs. 1–4. *Nematoscelis microps*, G. O. Sars.

Fig. 1. Ovigerous female, from right side ; magnified about nine times.

Fig. 2. Anterior part of body, from above.

Fig. 3. Extremity of a leg of first pair.

Fig. 4. Extremity of tail, with caudal fan, from above.

Figs. 5–7. *Nematoscelis tenella*, G. O. Sars.

Fig. 5. Female, from left side ; magnified about fourteen times.

Fig. 6. Anterior part of body, from above.

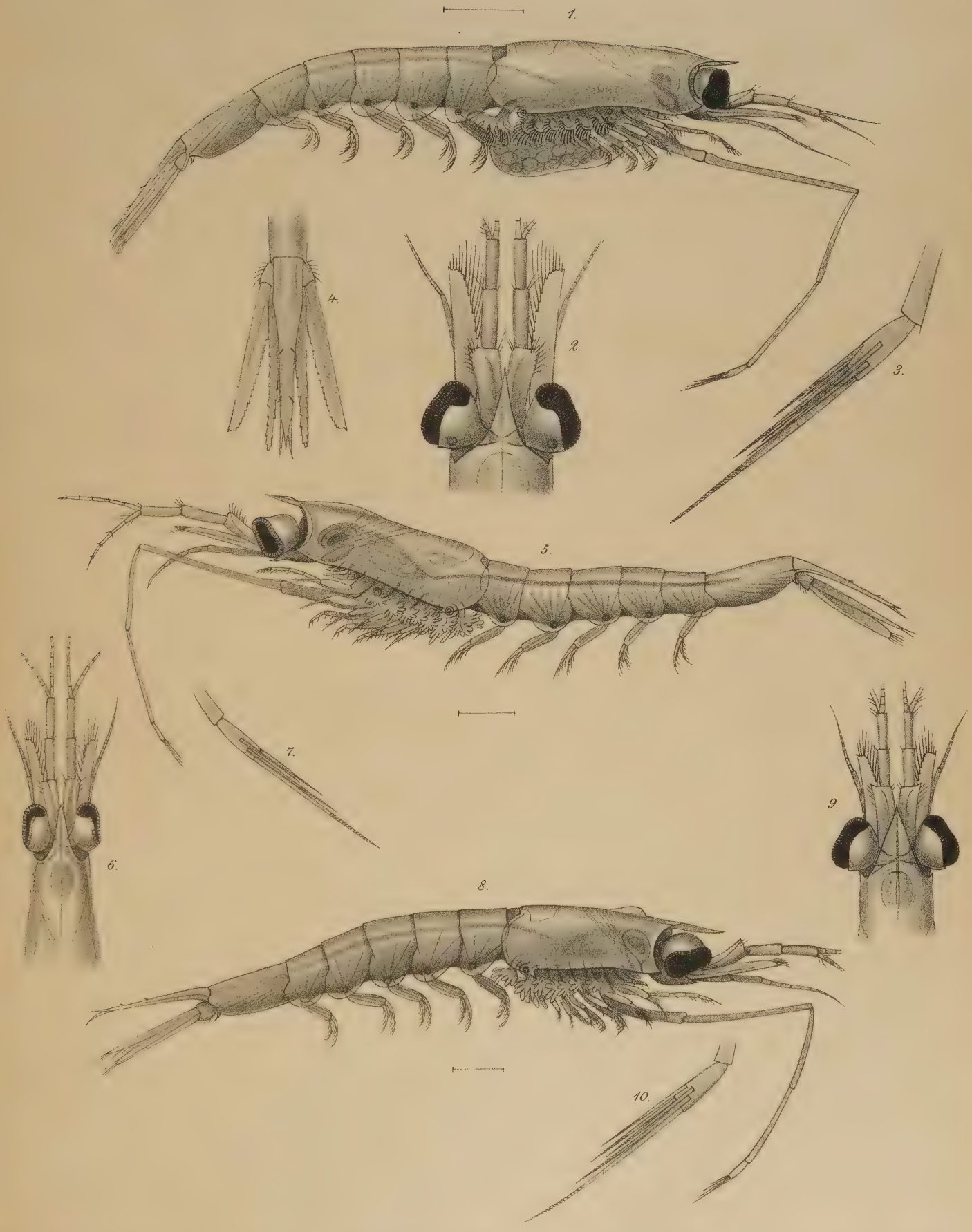
Fig. 7. Extremity of a leg of first pair.

Figs. 8–10. *Nematoscelis rostrata*, G. O. Sars.

Fig. 8. Female, from right side ; magnified about fourteen times.

Fig. 9. Anterior part of body, from above.

Fig. 10. Extremity of a leg of first pair.



G. O. Sars, del.

Lith. W. Schlachter, Stockholm.

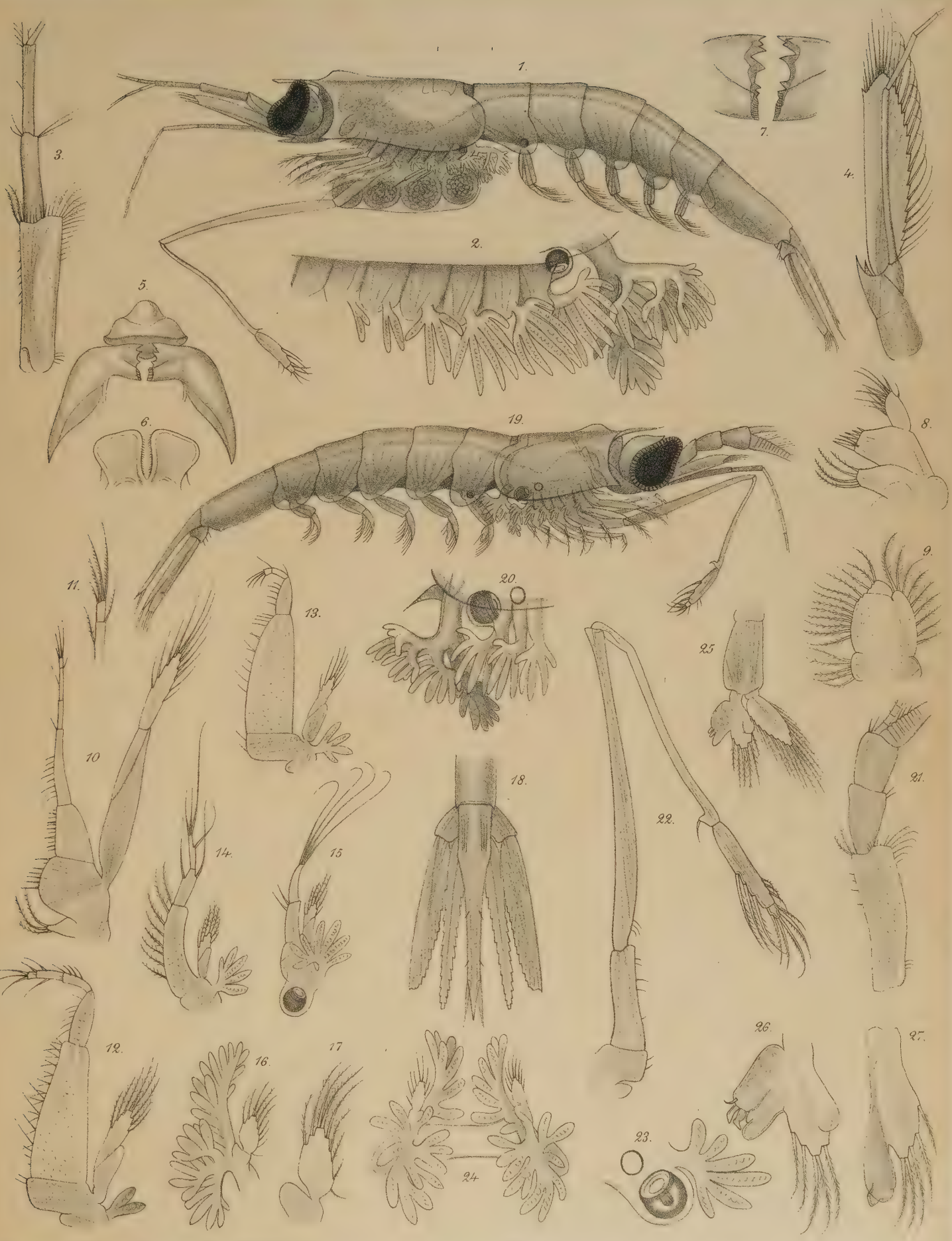
Figs 1–4, NEMATOSCELIS MICROPS, n. sp. Figs 5–7, NEMATOSCELIS TENELLA, n. sp.
Figs 8–10, NEMATOSCELIS ROSTRATA, n. sp.

PLATE XXVI.

PLATE XXVI.

Stylocheiron carinatum, G. O. Sars.

Fig. 1. Ovigerous female, from left side; magnified about fourteen times.
Fig. 2. Left side of trunk, with the gills *in situ*, from outer face.
Fig. 3. Right antennular peduncle, from above.
Fig. 4. Right antenna, with scale and proximal part of flagellum, from below.
Fig. 5. Anterior lip and mandibles.
Fig. 6. Posterior lip.
Fig. 7. Masticatory parts of mandibles, exhibiting the armature of the cutting edges.
Fig. 8. Maxilla of first pair.
Fig. 9. Maxilla of second pair.
Fig. 10. Maxilliped.
Fig. 11. Extremity of same; more highly magnified.
Fig. 12. Leg of third pair.
Fig. 13. Leg of fourth pair.
Fig. 14. Leg of fifth pair.
Fig. 15. Leg of penultimate pair, with luminous organ.
Fig. 16. Gill of last pair, with rudiment of leg.
Fig. 17. Rudimentary leg of last pair, isolated, and more highly magnified.
Fig. 18. Extremity of tail, with caudal fan, from above.
Fig. 19. Adult male, from right side.
Fig. 20. The four posterior gills on right side of same, with the greatly developed luminous organ at base of penultimate pair.
Fig. 21. Right male antennular peduncle, from above.
Fig. 22. Leg of second pair (exopod and gill omitted).
Fig. 23. Gill of penultimate pair in male, with the luminous organ.
Fig. 24. Last pair of gills, from below.
Fig. 25. Male pleopod of first pair.
Fig. 26. Inner plate of same; more highly magnified.
Fig. 27. Inner plate of a male pleopod of second pair.



G. O. Sars, del.

Lith. W. Schlachter Stockholm.

STYLOCHEIRON CARINATUM, n. gen. & sp.

PLATE XXVII.

PLATE XXVII.

Figs. 1–4. *Stylocheiron suhmii*, G. O. Sars.

Fig. 1. Female, from right side; magnified about eighteen times.

Fig. 2. Antennal scale.

Fig. 3. Extremity of a leg of second pair.

Fig. 4. Anterior part of body of a male specimen, from above.

Fig. 5. *Stylocheiron longicorne*, G. O. Sars.

Fig. 5. Female, from right side; magnified about eighteen times.

Figs. 6–10. *Stylocheiron elongatum*, G. O. Sars.

Fig. 6. Adult male, from right side; magnified about twelve times.

Fig. 7. Antennal scale.

Fig. 8. Extremity of a leg of second pair.

Fig. 9. Inner plate of a male pleopod of first pair.

Fig. 10. Inner plate of a male pleopod of second pair.

Figs. 11–13. *Stylocheiron abbreviatum*, G. O. Sars.

Fig. 11. Female, from left side; magnified about eighteen times.

Fig. 12. Right antenna, with scale and proximal part of flagellum, from below

Fig. 13. Extremity of a leg of second pair, forming a complete chela.

G. O. Sars, del.

Lith. W. Schlachter, Stockholm.

Figs 1–4, STYLOCHEIRON SUHMII, n. sp. Fig. 5, STYLOCHEIRON LONGICORNE, n. sp.
„ 6–10, „ ELONGATUM, n. sp. „ 11–13, „ ABBREVIATUM, n. sp.

PLATE XXVIII.

PLATE XXVIII.

Nyctiphanes australis, G. O. Sars.

(Early larval stages.)

Fig. 1. Larva in Metanauplius stage, from above; highly magnified.

Fig. 2. Same, from left side.

Fig. 3. Same, from below, more strongly magnified, exhibiting the budding limbs behind the anterior lip.

Fig. 4. Larva in first Calyptopis stage, from right side; highly magnified.

Fig. 5. Same, from above.

Fig. 6. Same, from below; more strongly magnified.

Fig. 7. Anterior prominence of ocular segment, with the ocellus.

Fig. 8. One of the antennulæ.

Fig. 9. One of the antennæ.

Fig. 10. Anterior lip and mandibles.

Fig. 11. Posterior lip.

Fig. 12. Mandible.

Fig. 13. Cutting edge of left mandible.

Fig. 14. Cutting edge of right mandible.

Fig. 15. Appendicular plate of cutting edge.

Fig. 16. Maxilla of first pair.

Fig. 17. Maxilla of second pair.

Fig. 18. Maxilliped.

Fig. 19. Extremity of tail, from below.

Fig. 20. Larva in second Calyptopis stage, from left side; highly magnified.

Fig. 21. One of the antennulæ.

Fig. 22. Extremity of tail, from below.

Fig. 23. Larva in last Calyptopis stage, from right side; highly magnified.

Fig. 24. Left antennulæ, from above.

Fig. 25. Maxilla of first pair.

Fig. 26. Extremity of tail, with telson and uropoda, from below.

G. O. Sars, del.

Lith. W. Schlachter, Stockholm.

NYCTIPHANES AUSTRALIS, n. sp.
(Early larval stages).

PLATE XXIX.

PLATE XXIX.

Euphausia pellucida, Dana.

(Development.)

Fig. 1. Larva in second Calyptopis stage, from left side; highly magnified.

Fig. 2. Same, from above.

Fig. 3. Larva in last Calyptopis stage, from left side.

Fig. 4. Larva in first Furcilia stage, from right side.

Fig. 5. Same, from above.

Fig. 6. Larva in an intermediate Furcilia stage, from left side.

Fig. 7. Larva in last Furcilia stage, from right side.

Fig. 8. Anterior part of a larva in first Cyrtopia stage, from right side.

Fig. 9. Anterior part of a larva in a later Cyrtopia stage, from left side.

Fig. 10. Young *Euphausia*, with all its limbs developed, from left side; magnified about twenty times.

G. O. Sars, del.

Lith. W. Schlachter Stockholm.

EUPHAUSIA PELLUCIDA, Dana.
(Development)

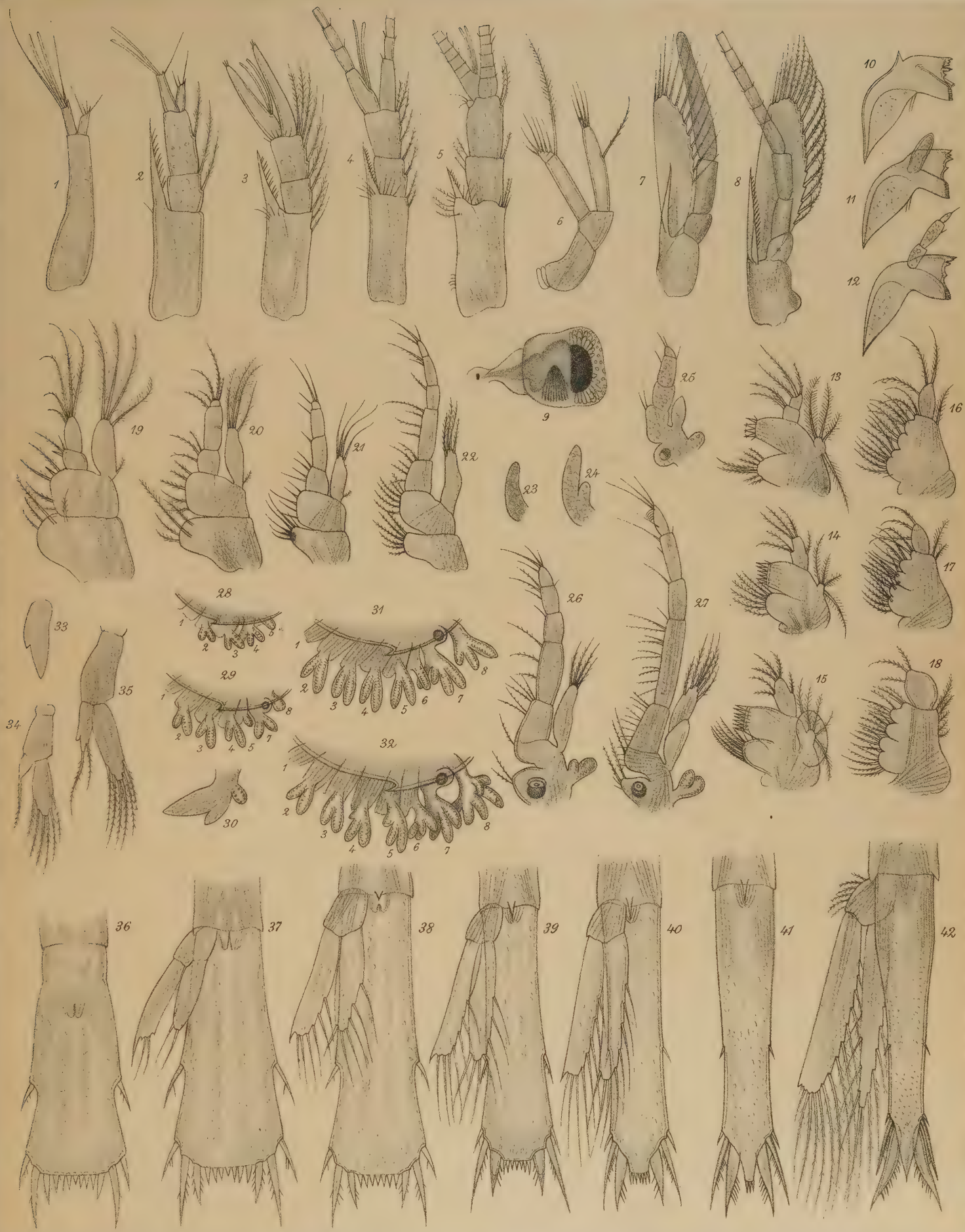
PLATE XXX.

PLATE XXX.

Euphausia pellucida, Dana.

(Development of the limbs.)

Fig. 1. Left antennula of a larva in second Calyptopis stage.
Fig. 2. Same part of a larva in last Calyptopis stage.
Fig. 3. Same part of a larva in last Furcilia stage.
Fig. 4. Same part of a larva in first Cyrtopia stage.
Fig. 5. Same part of a young *Euphausia*.
Fig. 6. Right antenna of a larva in last Furcilia stage, from below.
Fig. 7. Same part of a larva in first Cyrtopia stage.
Fig. 8. Same part of a young *Euphausia*.
Fig. 9. Ocular segment, with left eye, of a larva in second Furcilia stage, from below.
Fig. 10. Mandible of a larva in first Furcilia stage.
Fig. 11. Same part of a larva in last Cyrtopia stage.
Fig. 12. Same part of a young *Euphausia*.
Fig. 13. Maxilla of first pair of a larva in last Calyptopis stage
Fig. 14. Same part of a larva in last Cyrptopia stage.
Fig. 15. Same part of a young *Euphausia*.
Fig. 16. Maxilla of second pair of a larva in last Calyptopis stage
Fig. 17. Same part of a larva in last Cyrtopia stage.
Fig. 18. Same part of a young *Euphausia*.
Fig. 19. Maxilliped of a larva in last Calyptopis stage.
Fig. 20. Same part of a larva in first Cyrtopia stage.
Fig. 21. Same part of a larva in an intermediate Cyrtopia stage.
Fig. 22. Same part of a larva in last Cyrtopia stage.
Fig. 23. Leg of first pair of a larva in first Furcilia stage.
Fig. 24. Same part of a larva in an immediately following Furcilia stage.
Fig. 25. Same part of a larva in second Furcilia stage.
Fig. 26. Same part of a larva in last Furcilia stage.
Fig. 27. Same part of a larva in last Cyrtopia stage.
Fig. 28. Left side of trunk, with gills, of a larva in last Furcilia stage.
Fig. 29. Same part of a larva in first Cyrtopia stage.
Fig. 30. Leg of fourth pair, with rudiment of gill of same larva.
Fig. 31. Left side of trunk, with gills, of a larva in second Cyrtopia stage.
Fig. 32. Same part of a young *Euphausia*.
Fig. 33. Pleopod of first pair of a larva in first Furcilia stage.
Fig. 34. Same part of a larva in second Furcilia stage.
Fig. 35. Same part of a larva in last Furcilia stage.
Fig. 36. Extremity of tail of a larva in second Calyptopis stage, from below.
Fig. 37. Same part, with right uropod, of a larva in last Calyptopis stage.
Fig. 38. Same part of a larva in first Furcilia stage.
Fig. 39. Same part of a larva in second Furcilia stage.
Fig. 40. Same part of a larva in last Furcilia stage.
Fig. 41. Telson of a larva in first Cyrtopia stage.
Fig. 42. Extremity of tail, with telson and right uropod of a larva in last Cyrtopia stage.



G. O. Sars, del.

Lith. W. Schlachter, Stockholm.

EUPHAUSIA PELLUCIDA, Dana.

(Development of the limbs)

PLATE XXXI.

PLATE XXXI.

Figs. 1–22. *Thysanopoda tricuspidata*, Milne-Edwards.

(Development.)

Fig. 1. Larva in second Calyptopis stage, from left side; highly magnified.
Fig. 2. Larva in last Calyptopis stage, from right side.
Fig. 3. Larva in first Furcilia stage, from left side.
Fig. 4. Same, from above.
Fig. 5. Larva in second Furcilia stage, from right side.
Fig. 6. Larva in second Cyrtopia stage, from left side.
Fig. 7. Eyes of a larva in last Calyptopis stage.
Fig. 8. Eye of a larva in second Furcilia stage.
Fig. 9. Same part of a larva in second Cyrtopia stage.
Fig. 10. Anterior part of body of a young *Thysanopoda*, from above.
Fig. 11. Same part, from left side.
Fig. 12. Tip of lateral protuberance of eye, with seven corneal lenses.
Fig. 13. Mandible of a larva in last Calyptopis stage.
Fig. 14. Maxilla of first pair of same.
Fig. 15. Maxilla of second pair of same.
Fig. 16. Maxilliped of same.
Fig. 17. Extremity of tail of same larva, with telson and right uropod, from above.
Fig. 18. Telson of a larva in first Furcilia stage.
Fig. 19. Extremity of telson of a larva in second Furcilia stage.
Fig. 20. Same part of a larva in first Cyrtopia stage.
Fig. 21. Same part of a larva in last Cyrtopia stage.
Fig. 22. Same part of a young *Thysanopoda*.

Figs. 23–29. *Nematoscelis rostrata*, G. O. Sars.

(Development.)

Fig. 23. Larva in Furcilia stage, from right side; highly magnified.
Fig. 24. Larva in a subsequent Furcilia stage, from left side.
Fig. 25. Larva in Cyrtopia stage, from right side; magnified about twenty-four times.
Fig. 26. Legs of first and second pairs of the larva represented in fig. 23, isolated, and more highly magnified.
Fig. 27. Telson of same larva, from above.
Fig. 28. Extremity of telson of the larva represented in fig. 24.
Fig. 29. Same part of a larva in Cyrtopia stage.

Figs. 30–31. *Euphausia* sp. (?).

(Larval stage.)

Fig. 30. Larva in first Furcilia stage, from right side; magnified about eighteen times.
Fig. 31. Extremity of tail of same larva, with telson and right uropod, from above.

Figs 1-22, THYSANOPODA TRICUSPIDATA, Edw.
Figs 23-29, NEMATOSCELIS ROSTRATA, G. O. Sars. Figs 30-31, EUPHAUSIA ? sp.
(Development.)

PLATE XXXII.

PLATE XXXII.

Figs. 1–9. *Petalophthalmus armiger*, Willemoes-Suhm.

Fig. 1. Adult male, from left side; magnified about four times.

Fig. 2. Anterior part of body, from above.

Fig. 3. One of the petaloid eyes.

Fig. 4. Right antenna, from outer side.

Fig. 5. Gnathopod.

Fig. 6. Maxilliped.

Fig. 7. A pleopod.

Fig. 8. Extremity of tail, with telson and right uropod, from above.

Fig. 9. Tip of telson; more highly magnified.

Figs. 10–20. *Boreomysis scyphops*, G. O. Sars.

Fig. 10. Adult female, from left side; very slightly magnified.

Fig. 11. Anterior division of body, together with first caudal segment, from left side; somewhat more magnified. The free parts of the carapace have been removed to show the segments of the trunk with their branchial folds; moreover, the gnathopods and legs are omitted, to show the seven incubatory lamellæ issuing from their bases.

Fig. 12. Anterior division of body, together with the two anterior caudal segments, from above. The dorsal body-wall, together with the viscera, have been removed to show the nervous cord.

Fig. 13. Left eye, from outer face.

Fig. 14. Mandible, with palp.

Fig. 15. Maxilla of first pair.

Fig. 16. Maxilla of second pair.

Fig. 17. Maxilliped; the terminal part of the exopodite is omitted.

Fig. 18. Gnathopod, with attached incubatory lamella.

Fig. 19. Outer part of a leg.

Fig. 20. Extremity of tail, with telson and left uropod, from above.

G. O. Sars, del.

Lith. W. Schlachter Stockholm.

Figs 1-9, PETALOPHTHALMUS ARMIGER, Willem. Suhm ♂
10-20, BOREOMYSIS SCYPHOPS, G. O Sars. ♀

PLATE XXXIII.

PLATE XXXIII.

Figs. 1–6. *Boreomysis obtusata*, G. O. Sars.

Fig. 1. Adult male, from left side; magnified about five times.

Fig. 2. Carapace, with eyes, antennulæ and antennæ, from above.

Fig. 3. Frontal margin.

Fig. 4. Antennal scale.

Fig. 5. Outer part of a leg.

Fig. 6. Telson, from above.

Figs. 7–10. *Boreomysis microps*, G. O. Sars.

Fig. 7. Adult female, from above; magnified about six times.

Fig. 8. Anterior part of body, with eyes, right antennular peduncle, and right antenna, from above.

Fig. 9. Telson, from above.

Fig. 10. Extremity of same; more highly magnified.

Figs. 11–16. *Amblyops crozetii*, Willemoes-Suhm MS.

Fig. 11. Adult male, from above; magnified about five times.

Fig. 12. Same, from right side.

Fig. 13. Right antenna, with scale and proximal part of flagellum, from below.

Fig. 14. Endopod of one of the anterior legs.

Fig. 15. Endopod of a leg of last pair.

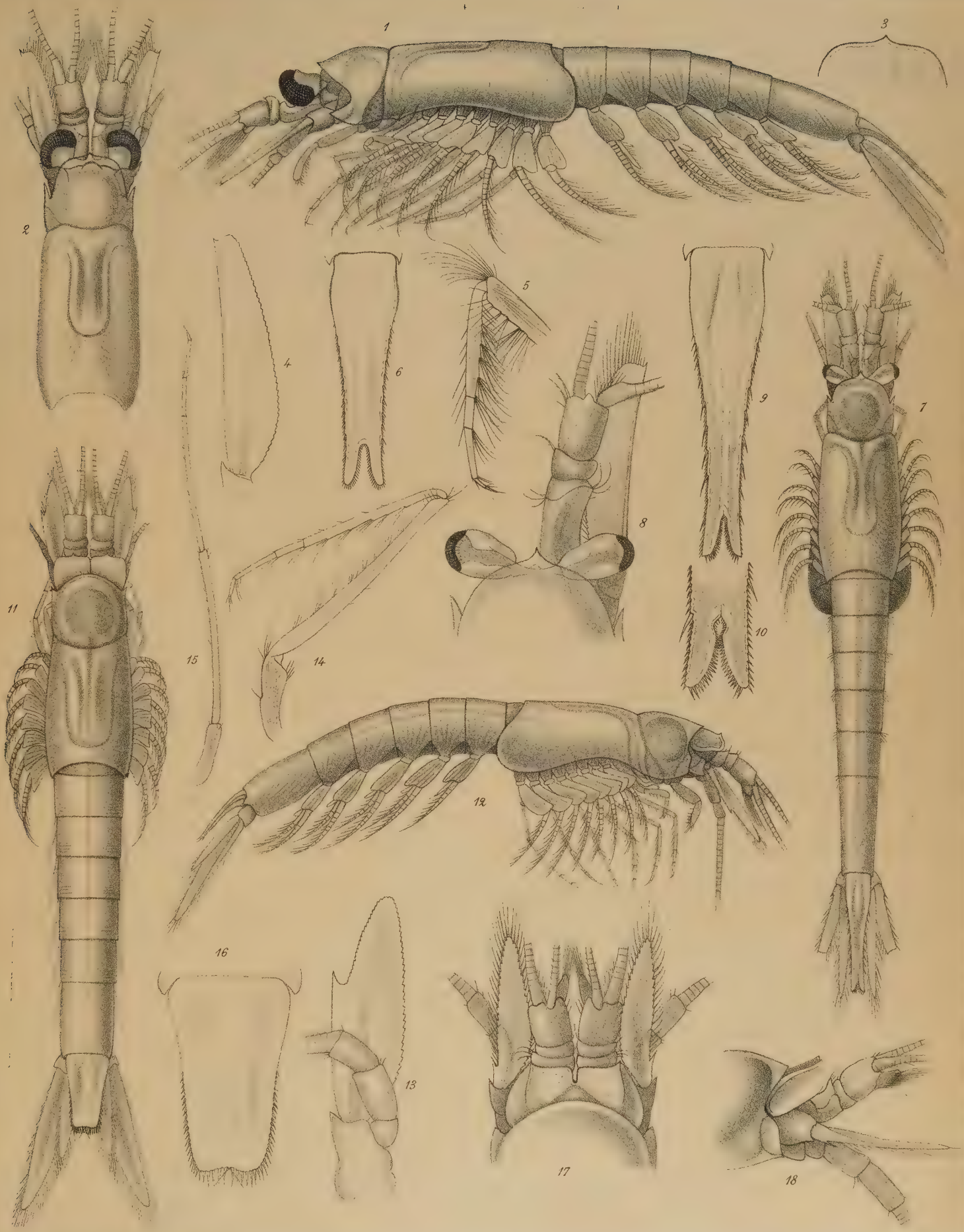
Fig. 16. Telson, from above.

Figs. 17–18. *Pseudomma australe*,[1] G. O. Sars.

Fig. 17. Anterior part of body of a male specimen, from above; highly magnified.

Fig. 18. Same part, from right side.

[1] *Amblyops* by mistake on the plate.



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Figs 1-6, BOREOMYSIS OBTUSATA, n. sp ♂ Figs 11-16, AMBLYOPS CROZETII, Willem. Suhm. M. S. ♂

„ 7-10, „ MICROPS n. sp. ♀ „ 17-18, „ AUSTRALIS, n. sp. ♂

PLATE XXXIV.

PLATE XXXIV.

Figs. 1–3. *Pseudomma sarsii*, Willemoes-Suhm MS.

Fig. 1. Adult male, from above; magnified about ten times.

Fig. 2. Antennal scale.

Fig. 3. Telson, from above.

Figs. 4–27. *Anchialus typicus*, Kröyer.

Fig. 4. Adult ovigerous female, from right side; magnified about twelve times.

Fig. 5. Same, from above.

Fig. 6. Adult male, from left side.

Fig. 7. Frontal part of carapace, with rostral projection, from above.

Fig. 8. Right antennular peduncle of male, from below.

Fig. 9. Left antenna, with scale and proximal part of flagellum, from above.

Fig. 10. Anterior lip.

Fig. 11. Posterior lip.

Fig. 12. Mandible, with palp.

Fig. 13. Cutting edges of mandibles.

Fig. 14. Maxilla of first pair.

Fig. 15. Maxilla of second pair.

Fig. 16. Maxilliped.

Fig. 17. Male gnathopod.

Fig. 18. Leg of first pair of male.

Fig. 19. Leg of second pair.

Fig. 20. Outer part of a leg of last pair.

Fig. 21. Male sexual appendage.

Fig. 22. Anterior part of tail of female, viewed from the ventral face, to show the two anterior pairs of caudal limbs and the epimera of first segment.

Fig. 23. Male pleopod of first pair.

Fig. 24. Male pleopod of fourth pair.

Fig. 25. Extremity of outer branch of same pleopod; more highly magnified.

Fig. 26. Telson, from above.

Fig. 27. Right uropod, from above.

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Figs 1-3, PSEUDOMMA SARSII, Willem. Suhm, M. S.
4-27, ANCHIALUS TYPICUS, Kröyer.

PLATE XXXV.

PLATE XXXV.

Figs. 1–18. *Anchialus angustus*, G. O. Sars.

Fig. 1. Adult female, from right side; magnified about fourteen times.
Fig. 2. Same, from above.
Fig. 3. Anterior part of carapace, from right side.
Fig. 4. Left antennular peduncle of male, from above.
Fig. 5. Left antenna, with scale and proximal part of flagellum, from above.
Fig. 6. Anterior lip.
Fig. 7. Posterior lip.
Fig. 8. Mandible, with palp.
Fig. 9. Maxilla of first pair.
Fig. 10. Maxilla of second pair.
Fig. 11. Maxilliped (exopodite omitted).
Fig. 12. Male gnathopod (exopod omitted).
Fig. 13. Endopod of a leg.
Fig. 14. Male pleopod of second pair.
Fig. 15. Basal expansion of inner branch of same pleopod, more highly magnified.
Fig. 16. Male pleopod of fourth pair.
Fig. 17. Telson, from above.
Fig. 18. Right uropod, from above.

Figs. 19, 20. *Anchialus pusillus*, G. O. Sars.

Fig. 19. Adult female, from right side; highly magnified.
Fig. 20. Anterior part of body of another female specimen, obliquely from above.

Figs. 21–23. *Mysidopsis incisa*, G. O. Sars.

Fig. 21. Adult female, from left side; magnified about twenty times.
Fig. 22. Right antenna, with scale and proximal part of flagellum, from above.
Fig. 23. Extremity of tail, with telson and basal portion of right uropod, from above.

G. O. Sars, del.

Lith. W. Schlachter Stockholm.

Figs 1-18 ANCHIALUS ANGUSTUS n. sp. Figs 19-20, ANCHIALUS PUSILLUS, n. sp
Figs 21-23 MYSIDOPSIS INCISA, n. sp.

PLATE XXXVI.

PLATE XXXVI.

Figs. 1–24. *Siriella thompsonii*, Milne-Edwards.

Fig. 1. Adult male, from left side ; magnified about fourteen times.

Fig. 2. Adult female, from right side.

Fig. 3. Same, from above.

Fig. 4. Left antennular peduncle of male, with the hispid lobe, from inner side.

Fig. 5. Outer part of same peduncle, from below ; more highly magnified. The hairs have been removed from the male appendage to show the double band giving origin to the hairs.

Fig. 6. Left antennæ, with scale and proximal part of flagellum, from below.

Fig. 7. Anterior lip and mandibles, from below.

Fig. 8. Terminal joint of mandibular palp ; more highly magnified.

Fig. 9. Cutting edges of mandibles.

Fig. 10. Maxilla of first pair.

Fig. 11. Maxilla of second pair.

Fig. 12. Maxilliped.

Fig. 13. Gnathopod.

Fig. 14. One of the anterior legs ; somewhat less magnified.

Fig. 15. Outer part of same ; more highly magnified.

Fig. 16. Leg of last pair, with male sexual appendage.

Fig. 17. Male sexual appendage, isolated, and more highly magnified.

Fig. 18. Male pleopod of first pair.

Fig. 19. Male pleopod of second pair.

Fig. 20. Branchial lobe of a pleopod of first pair.

Fig. 21. Branchial lobe of a pleopod of second pair.

Fig. 22. Telson, from above.

Fig. 23. Extremity of same ; more highly magnified.

Fig. 24. Right uropod, from above.

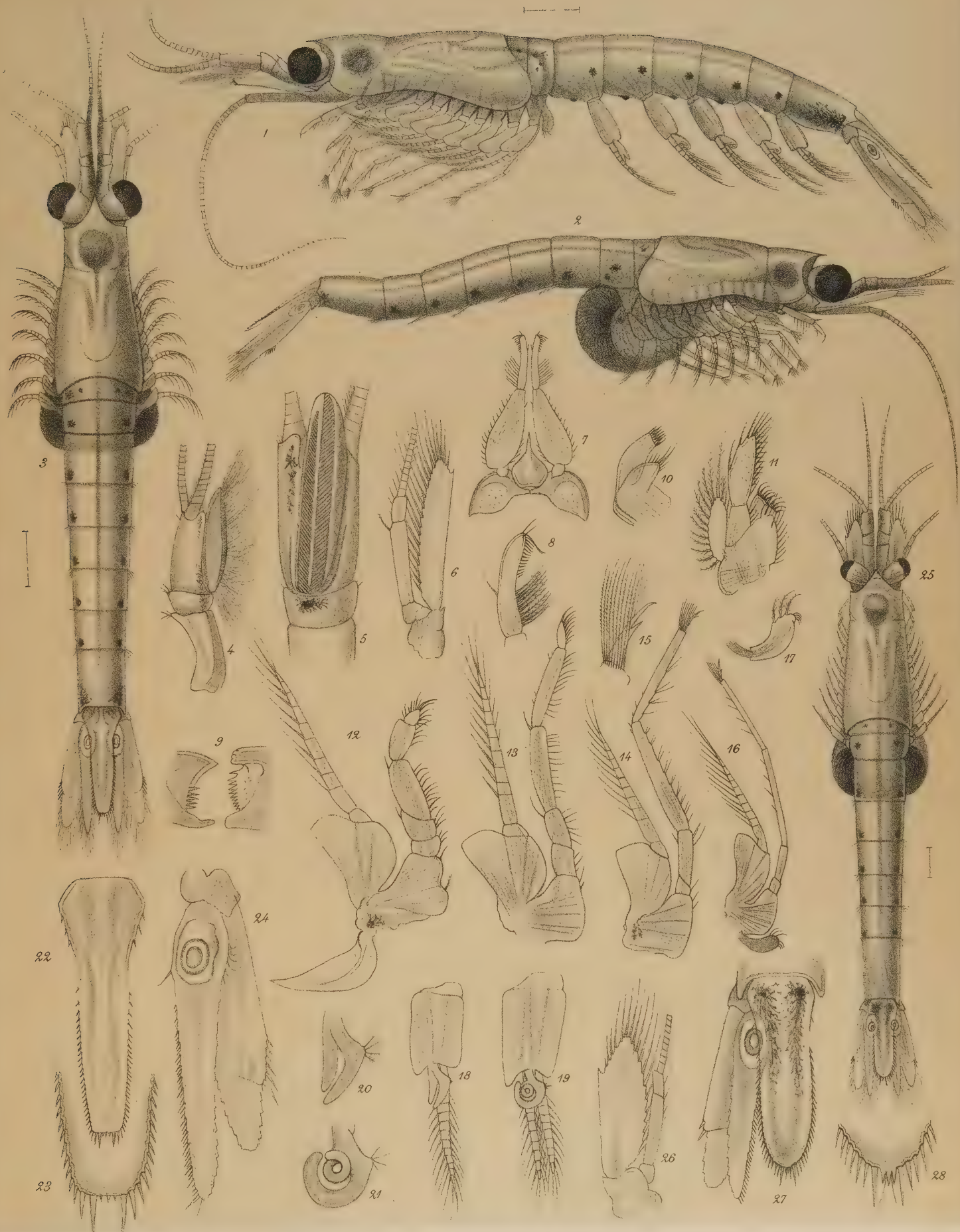
Figs. 25–28. *Siriella gracilis*, Dana.

Fig. 25. Adult female, from above ; magnified about twenty times.

Fig. 26. Right antenna, with scale and proximal part of flagellum, from below.

Fig. 27. Extremity of tail, with telson and left uropod, from above.

Fig. 28. Tip of telson ; more highly magnified.



G. O. Sars, del.

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Figs 1-24, SIRIELLA THOMPSONII, (Edw.)
„ 25-28, „ GRACILIS, Dana.

PLATE XXXVII.

PLATE XXXVII.

Figs. 1–20. *Euchætomera typica*, G. O. Sars.

Fig. 1. Adult female, from above; magnified about eleven times.
Fig. 2. Right antennular peduncle, from above.
Fig. 3. Left antenna, with scale and proximal part of flagellum, from above
Fig. 4. Anterior lip.
Fig. 5. Posterior lip.
Fig. 6. Mandible, with palp.
Fig. 7. Cutting edges of mandibles.
Fig. 8. Maxilla of first pair.
Fig. 9. Maxilla of second pair.
Fig. 10. Maxilliped.
Fig. 11. Gnathopod.
Fig. 12. Leg of first pair.
Fig. 13. Extremity of same; more highly magnified.
Fig. 14. Outer part of a leg of last pair.
Fig. 15. Caudal limb of first pair of female.
Fig. 16. Caudal limb of last pair of female.
Fig. 17. One of the marginal setæ of same; highly magnified
Fig. 18. Male pleopod of first pair.
Fig. 19. Left uropod, from above.
Fig. 20. Telson, from above.

Figs. 21–24. *Euchætomera tenuis*, G. O. Sars.

Fig. 21. Female, from above; magnified about fifteen times.
Fig. 22. Right antenna, with scale and proximal part of flagellum, from above
Fig. 23. Endopod of a leg.
Fig. 24. Telson, from above.

G. O. Sars, del.

Lith. W. Schlachter

Figs 1-20, EUCHÆTOMERA TYPICA, n. gen. & sp.
„ 21-24, „ TENUIS, n. sp.

PLATE XXXVIII.

PLATE XXXVIII.

Figs. 1–7. *Heteromysis bermudensis*, n. sp.

Fig. 1. Adult female, from right side; magnified about eighteen times.

Fig. 2. Same, from above.

Fig. 3. Left antennular peduncle, from above.

Fig. 4. Antennal scale.

Fig. 5. Telson, from above.

Fig. 6. Young, in pupa-stage, extracted from the marsupial pouch, and viewed from right side; highly magnified.

Fig. 7. Same, from below.

Figs. 8–14. *Ecto-Parasites of Schizopoda.*

Fig. 8. *Heterophryxus appendiculatus*, n. gen. et sp., affixed to the dorsal face of a specimen of *Euphausia pellucida;* lateral view. *a*, female; *b*, male.

Fig. 9. *Notophryxus lateralis*, n. sp. (*a*), affixed to base of penultimate gill of a specimen of *Nematoscelis megalops;* lateral view.

Fig. 10. Same parasite together with male (*a*), from below; more highly magnified.

Fig. 11. *Notophryxus globularis*, n. sp. (*a*), affixed to the posterior part of the dorsal face of carapace in a specimen of *Thysanoëssa gregaria;* lateral view.

Fig. 12. *Dajus siriellæ*, n. sp., female, with male (*a*) affixed, viewed from above; highly magnified.

Fig. 13. Same (female and male), from below.

Fig. 14. Male, isolated and viewed from above; more highly magnified.

Figs. 15–23. *Endo-Parasites of Schizopoda.*

Fig. 15. *Echinorhynchus corrugatus*, n. sp., lying within the perivisceral cavity of a specimen of *Euphausia pellucida;* lateral view.

Fig. 16. Same, isolated, and more highly magnified.

Fig. 17. Anterior extremity of same, with proboscis protruded.

Fig. 18. One of the hooks from the proboscis; highly magnified.

Fig. 19. *Distomum filiferum*, Leuckart, M.S., attached within the perivisceral cavity of a specimen of *Nematoscelis megalops;* lateral view.

Fig. 20. A specimen of the parasite, together with the sac-like body, isolated, and viewed from below.

Fig. 21. Another specimen, with the byssus thread exserted, from left side.

Fig. 22. Fragment of a byssus thread together with a number of fine adhesive fibres; highly magnified.

Fig. 23. A packet of adhesive fibres.

G. O. Sars, del.

Lith. W. Schlachter Stockholm.

Figs 1-7, HETEROMYSIS BERMUDENSIS, n. sp.
„ 8-23, ECTO- & ENTO-PARASITES of Schizopoda.

The Zoology of the Voyage of H.M.S. Challenger.

Vol. XIII.

PART XXXVII.

REPORT ON THE SCHIZOPODA.

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